

*Prepared for*

**Settling Work Defendants**

# **DRAFT LEADING EDGE INVESTIGATION WORK PLAN**

## **OMEGA SUPERFUND SITE OPERABLE UNIT 2**

*Prepared by*

**Geosyntec**   
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engineers | scientists | innovators

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Project Number: WR2209

27 September 2016

# **Draft** Leading Edge Investigation Work Plan

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*Prepared by*

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**LIST OF ACRONYMS, ABBREVIATIONS, AND COMMON TERMS**

2010 RI	August 2010 OU2 Remedial Investigation
2011 ROD	OU2 Interim Action Record of Decision, dated September 20, 2011
2016 CD	Consent Decree lodged April 20, 2016 covering Operable Unit 2 at the Omega Chemical Corporation Superfund Site
bgs	Below ground surface
CDWR	California Department of Water Resources
CE Area	Central extraction area (The location of the CE area is depicted in the 2016 CD, Appendix C as the area between the NE and Telegraph Road.)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	Chemicals of Concern
COPCs	Chemicals of Potential Concern
CSM	Conceptual Site Model
CSRS-H	California Spatial Reference System Horizontal
Day	Day means a calendar day unless expressly stated to be a working day. A working day is a day other than a Saturday, Sunday, or federal or state holiday.
DQOs	Data Quality Objectives
DTSC	California Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
ft bgs	Feet below ground surface
Geosyntec	Geosyntec Consultants, Inc.
HASP	Health and Safety Plan

IDW	Investigation-derived waste
LE	Leading Edge
LE Area	Leading Edge Area of OU2 is the area in the 2016 CD, Appendix C that is south of the CE Area
LEI	Leading Edge Investigation
LEI Work Plan	Leading Edge Investigation Work Plan
Main COCs	13 COCs identified in the ROD as “main COCs” and listed in Table 1. Includes eleven VOCs, 1,4-dioxane, and hexavalent chromium. The Main COCs are included in the COC list for the RD.
MCLs	Maximum Contaminant Levels (EPA and California)
µg/L	Micrograms per liter
msl	Mean sea level
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NE Area	Northern extraction area (The location of the NE area is depicted in Appendix C of the 2016 CD as an area north of the CE)
NE/CE Area	A portion of the area of the groundwater contamination identified by EPA as OU2 in its 2011 ROD. The NE/CE Area is bounded by the OU2 boundary as depicted in the 2016 CD, Appendix C and the area north of Telegraph Road. It includes the NE and CE areas as depicted in the ROD as well as the northern portion of the LE area as depicted in the ROD.
NL	Notification Level, California State Water Resources Control Board
OFRP	Oil Field Reclamation Project
Omega Property	The property formally owned by the Omega Chemical Corporation, encompassing approximately one acre, located at 12504 and 12512 East Whittier Blvd, Whittier, California.

	OU1 and OU3 are addressing soil, groundwater, and soil vapor source control at the Omega Property.
OU	Operable Unit, a discrete action that comprises an incremental step in the remediation of a contaminated site.
OU2	Operable Unit 2, the contamination in groundwater generally downgradient of Omega Property, much of which has commingled with chemicals released at other locations into a regional plume containing multiple contaminants which, when considered in total, is more than four miles long and one mile wide. The OU2 boundary is depicted in the 2016 CD, Appendix C.
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design (Remedial Design means those activities to be undertaken by Settling Work Defendants to develop the final plans and specifications for the Remedial Action pursuant to the Remedial Design Work Plan.)
RDWA	Remedial Design Work Area. (The RDWA consists of the NE/CE Area and includes potential treated water end use locations that may be adjacent to or outside of OU2.)
RL	Reporting Limit
RWQCB-LA	Regional Water Quality Control Board, Los Angeles Region
Site	Omega Chemical Corporation Superfund Site, originally listed on the National Priorities List on January 19, 1999, which is located in Los Angeles County, California, and includes the contamination being addressed by multiple Operable Units.
SOP	Standard Operating Procedure

SOW	Statement of Work, Appendix B to the 2016 CD.
SP	Spontaneous Potential
SVOCs	Semivolatile organic compounds
SWDs	Settling Work Defendants, as identified in Appendix E to the 2016 CD. SWDs include the McKesson Corporation and OPOG (Omega Chemical Corporation Superfund Site Potentially Responsible Party Organized Group).
TDS	Total dissolved solids
USA	Underground Service Alert
USCS	Unified Soil Classification System
USGS	United States Geologic Survey
UTM	Universal Transverse Mercator
VOCs	Volatile Organic Compounds
WAMP	Work Area Monitoring Plan
Work	All activities and obligations the SWDs are required to perform under the 2016 CD, except the activities required under the Retention of Records section of the 2016 CD.
Work Area	The portions of OU2 that are the subject of Work under the 2016 CD and the SOW.
WRD	Water Replenishment District of Southern California

**LIST OF ADDITIONAL ACRONYMS AND ABBREVIATIONS**

1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichlorethene
1,1,1-TCA	1,1,1-Trichloroethane
1,2-DCA	1,2-Dichloroethane
1,2,3-TCP	1,2,3-Trichloropropane
cis-1,2-DCE	cis-1,2-Dichloroethene
Freon 11	Trichlorofluoromethane
Freon 113	1,1,2-Trichloro-1,2,2,- trifluoroethane
NDMA	N-Nitrosodimethylamine
PCE	Tetrachloroethene
TCE	Trichloroethene

## **1. INTRODUCTION**

Geosyntec Consultants, Inc. (Geosyntec) has prepared this Leading Edge Investigation (LEI) Work Plan on behalf of the Settling Work Defendants (SWDs) for the Omega Chemical Corporation Superfund Site, Operable Unit 2 (Figure 1). This LEI Work Plan was prepared in accordance with Section 5.1 of the Statement of Work (SOW), Appendix B of the Consent Decree (2016 CD) for Operable Unit 2 (OU2) at the Omega Chemical Corporation Superfund Site (EPA, 2016). This LEI Work Plan describes the additional field investigations to be conducted in the Leading Edge (LE) Area within OU2 (Figure 2).

In accordance with the SOW, three monitoring well clusters will be installed in the LE Area “downgradient of the Continental Heat Treating property located at 10643 Norwalk Blvd. in Santa Fe Springs, California” in the approximate locations depicted in Appendix C of the 2016 CD (EPA, 2016) and shown on Figure 3. This LEI Work Plan describes the proposed installation, development, initial groundwater sampling, and reporting for the three LEI monitoring well clusters.

### **1.1 Work Plan Objectives:**

The SOW requires SWDs to conduct additional field investigation to evaluate the groundwater chemistry and vertical hydraulic gradients at three locations in the LE Area to a maximum depth of 500 feet below ground surface (ft bgs). These data will provide additional information on the nature and extent of groundwater contamination in the LE Area as well as the potential sources of such contamination.

Based on these objectives, three study goals were identified as follows:

- Determine the appropriate screen intervals for the wells in each LEI monitoring well cluster;
- Characterize the vertical distribution of volatile organic compounds (VOCs), 1,4-dioxane, and hexavalent chromium in the LEI monitoring wells; and
- Characterize the vertical groundwater gradients in the LE Area.

## **2. BACKGROUND**

### **2.1 Leading Edge Area Overview**

The Leading Edge Area (LE Area) is located in the southern portion of the OU2 and is presented in Figure 2. The LE Area is located downgradient of the Central Extraction Area (CE Area) and extends from south of Telegraph Road to the southern OU2 boundary (EPA 2016). The boundary of OU2 is defined in the 2011 ROD and the 2016 Consent Decree. Several groundwater production wells are located adjacent to or downgradient of the LE Area including Golden State Water Company (GSWC) production wells Pioneer 1, Pioneer 2, Pioneer 3 and Dace 1 (Figure 4). Previous investigations have been conducted in the LE Area by EPA, the United States Geologic Survey (USGS) and the Water Replenishment District of Southern California (WRD). Additionally, facility-specific investigations have been conducted within or adjacent to the LE Area at a number of sites, including, but not limited to, the former CENCO Oil Company Refinery, the former ExxonMobil Jalk Fee Property, the Continental Heat Treating site, the Ashland Chemicals blending, packaging and distribution center (although located outside the LE area, there is a potential for commingling of releases), the Beauman Family Trust property, and the PMC facility. The work covered by the SOW includes additional investigation in the LE Area (EPA, 2016).

### **2.2 Previous Investigations in the LE Area**

#### **2.2.1 EPA Remedial Investigation in the LE Area**

As part of the Remedial Investigation for OU2, EPA installed monitoring wells at four locations in the LE Area (Figure 5). One monitoring well cluster was installed with four nested wells in a single borehole (MW27A, B, C, and D) and individual wells were installed at three additional locations (MW28, MW29 and MW30).

At the MW27 well cluster, an initial exploratory boring was drilled to 225 feet below ground surface (ft bgs). The soil cuttings were logged and geophysical logging was conducted in the borehole. EPA selected four depth intervals for well screens for the installation of monitoring wells in the MW27 well cluster as follows:

- MW27A screened from 90 to 110 ft bgs;
- MW27B screened from 144 to 164 ft bgs;

- MW27C screened from 180 to 190 ft bgs; and
- MW27D screened from 200 to 210 ft bgs.

MW28, MW29 and MW30 were drilled with sonic equipment and the boreholes were continuously cored for lithologic logging. Based on the logging EPA selected the following depth intervals for well screens for the installations of these wells:

- MW28 screened from 85 to 105 ft bgs;
- MW29 screened from 90 to 110 ft bgs; and
- MW30 screened from 95 to 115 ft bgs.

The MW27 well cluster, MW28, MW29 and MW30 were sampled by EPA for the Main Chemicals of Concern (Main COCs) during the remedial investigation/feasibility study (RI/FS) and subsequent groundwater monitoring events. These wells have been included in the Work Area Monitoring Plan (WAMP) for future monitoring (Geosyntec, 2016).

### **2.2.2 EPA 2012 Investigation in the LE Area**

In 2012, EPA installed monitoring well MW32 in the LE Area (Figure 5). The stated objectives of the installation of MW32 were as follows:

- *“Confirm the continuity of VOC contamination between the currently identified OU2 groundwater plume and the Pioneer production wells;*
- *Assess the depth extent of VOC contamination upgradient of the Pioneer production wells; and*
- *Provide a permanent well location for ongoing groundwater monitoring between the currently identified OU2 groundwater plume and the Pioneer production wells” (CH2M Hill 2012).*

The MW32 borehole was drilled and continuously cored to 250 ft bgs. Discrete-depth groundwater samples were collected at 10-foot intervals during drilling. Based on the geologic logs and analytical data, MW32 was screened from 163 to 178 ft bgs. MW32 has been sampled for the Main COCs by EPA during groundwater monitoring events and is included in the WAMP for future monitoring (Geosyntec, 2016).

### **2.2.3 USGS and WRD Investigation in the LE Area**

The United States Geologic Survey (USGS) conducted a study in collaboration with the Water Replenishment District of Southern California (WRD), in which the WRD installed two monitoring well clusters in OU2: the Koontz well cluster and the Hawkins well cluster (Figure 5). The Hawkins monitoring well cluster was installed north of the LE Area, in the CE Area, and is not relevant to this Work Plan. The Koontz monitoring well cluster is located in the LE Area and was installed between August and September 2014. At the Koontz well cluster, an initial exploratory boring was drilled to 518 feet below ground surface (ft bgs). The soil cuttings were logged and geophysical logging was conducted in the borehole. The USGS and WRD selected five depth intervals for the installation of monitoring wells in the Koontz well cluster as follows:

- Koontz1a\_1 screened from 481 to 491 ft bgs;
- Koontz1b\_2 screened from 375 to 385 ft bgs;
- Koontz1c\_3 screened from 282 to 292 ft bgs;
- Koontz1c\_4 screened from 223 to 233 ft bgs; and
- Koontz1c\_5 screened from 150 to 160 ft bgs.

At the Koontz well cluster, three boreholes were drilled for the installation of the five well casings. Wells Koontz1a\_1 and Koontz1b\_2 were installed in separate boreholes. Wells Koontz 1c\_3, Koontz1c\_4 and Koontz1c\_5 were installed together as nested casings in a single borehole. WRD has been conducting periodic sampling of the Koontz monitoring wells and these wells are included in the WAMP for future annual monitoring (Geosyntec, 2016).

### **2.3 Land Use in and around the Leading Edge Area**

The majority of the LE area was irrigated agricultural land in the early 1900s and agricultural use persisted in this area through the 1950s (CH2M Hill, 2010). Beginning in 1907, oil and gas wells were installed as part of the Santa Fe Springs Oil Field and reached peak production by 1928. Commercial, industrial, and residential development started in the 1920s and 1930s. The historical industrial facilities included chemical manufacturing, processing, and distribution facilities; an oil refinery; oil production facilities, including oil and gas wells, storage facilities, and pipelines; machine shops;

plating shops; dry cleaners; manufacturing facilities; gas stations, auto repair, and truck servicing; aircraft parts and engines; laboratories; commercial printing; heat treating; and a wide variety of other businesses. Residential areas are present in the southern portion of the Leading Edge Area south of Lakeland Road and west of Balsam Street (Figure 6).

The central portion of the Santa Fe Springs Oil Field overlaps the LE Area (Figure 7). The California Department of Conservation, Division of Oil and Gas lists a total of 1,378 wells in the Santa Fe Springs Oil Field. Some of these wells are active, but a majority of them were abandoned. It is possible that oil production wells abandoned prior to about 1965 were not completely sealed (i.e., they were likely pressure grouted in the production interval, but not all the way to the ground surface) and their corroded and collapsed steel casings could provide conduits for downward groundwater flow and contaminant migration.

A subset of the known sources that have contributed to the groundwater contamination in the LE Area are currently under State oversight (California Department of Toxic Substances Control [DTSC] or Regional Water Quality Control Board, Los Angeles Region [RWQCB-LA]) and are currently being addressed by State-led actions. More than 20 sites have been identified south of Telegraph Road that are potential sources of groundwater contamination in the LE Area (Figure 8, Table 2). Several of the known sources in the LE Area include:

- The former CENCO Oil Company Refinery that was operated from the 1930s through July 1995 (CH2M Hill 2010). This site is regulated by the RWQCB-LA and the groundwater at the site is contaminated with petroleum hydrocarbons and benzene;
- The former ExxonMobil Jalk Fee Property that was used for oil production from the 1920s to the 1990s. This site is regulated by the RWQCB-LA and the groundwater at the site is contaminated with VOCs including PCE and TCE;
- The Continental Heat Treating site, which has been operated to process metal parts from 1969 to present. This site is regulated by the RWQCB-LA and operations at the site, including the use of a solvent degreaser, have resulted in releases of chlorinated solvents and contamination in groundwater;

- The Ashland Chemicals blending, packaging and distribution center (located outside the LE Area but near enough that commingling of the Ashland release to those releases in the LE Area could be occurring) that was operated from the 1960s through January 2002 (CH2M Hill 2010). This site is regulated by the RWQCB-LA and the groundwater at the site is contaminated with VOCs including benzene, toluene, xylenes TCE, and PCE;
- The Beauman Family Trust property, which operated as a drum recycling business from 1971 to 1986 and is regulated by DTSC. Contents were leaked or spilled to the ground surface over time and the groundwater at the site is contaminated with benzene, naphthalene, 1,1,-DCA, cis-1,2-DCE, vinyl chloride, chloroethane, 1,2-DCA, 1,4,dioxane, and arsenic; and
- The PMC facility, on which three businesses have operated; a cresylic acid plant (south portion of site), naphthenic acid plant (north portion of site) and alkylated phenol plant (central portion of site) from the late 1940s the early 1990s. The facility consisted of 171 above ground storage tanks that were used for raw chemicals, chemical product, and residual chemicals and sludges; 9 USTs, 20 towers, and 20 sumps. (DTSC, 2006, October, 25). The facility has a long record of spills and leaks from damaged infrastructure, pipelines, and both underground and above ground storage tanks.

The above list provides a small subset of the potential sources contributing to groundwater contamination in the LE Area. A large number of the potential source properties have not yet been adequately evaluated. In the 2011 ROD, EPA noted that the State will require source control actions at these facilities as needed and expects that, if and when additional source areas are identified, they will be addressed by the combined efforts of the State and EPA (EPA, 2011). Investigation of known and potential source areas in the LE Area continues. Figure 8 and Table 2 provide additional information on known source properties in and adjacent to the LE Area.

## **2.4 General Setting**

The LE Area extends from Santa Fe Springs into the city of Norwalk.

### **2.4.1 Topography**

In the northern portion of the LE Area the ground surface flattens into a broad basin or plain, at an elevation of approximately 150 to 155 feet above msl. In the southwestern portion of LE Area, the ground surface rises gently to approximately 160 feet above msl at the northwest end of the Santa Fe Springs plain.

### **2.4.2 Hydrology**

The San Gabriel River, Rio Hondo River, spreading basins, and the Sorensen Avenue Drain form the principal surface water features in the general vicinity (Figure 9) (CH2MHill, 2010). The San Gabriel River lies just west of Interstate 605 and generally flows from northeast to southwest; Rio Hondo is further west of the San Gabriel River. The spreading basins are located along the channel of the San Gabriel River and Rio Hondo, and receive imported and treated water to artificially recharge the basin. The Sorensen Avenue Drain is a small drain that flows across the basin toward the southeast from a point near the intersection of Dice Road and Slauson Avenue. This channel bends toward the south beyond the limits of LE Area to become La Canada Verde Creek, which cuts through a low gap between the Coyote Hills on the east and the Santa Fe Springs plain on the west.

The San Gabriel River channel is unlined in the Montebello Forebay and the river is a losing stream in this area. The river channel is lined south of the Montebello Forebay and the recharge from the lined portion of the river is expected to be limited. The San Gabriel and the Rio Hondo spreading basins are the major groundwater replenishment sources for the Central Basin. Areal recharge including infiltration from precipitation and return flow from irrigation and mountain front recharge occurring along the basin boundaries are the remaining, but much smaller, groundwater recharge components in the Central Basin. Even before the artificial recharge program began, the Montebello Forebay was a major recharge area because of the unconfined conditions and the presence of the San Gabriel River and Rio Hondo.

The San Gabriel River Watershed falls within Los Angeles County. In 1999, the Los Angeles County Board of Supervisors directed the Los Angeles Department of Public

Works (in cooperation with the County Departments of Parks and Recreation and Regional Planning) to prepare a San Gabriel River Master Plan. A watershed management plan for the Coyote Creek sub-watershed is in development by the RWQCB-LA. Several small creeks drain the southwestern slopes of the Puente Hills including the Turnbull Canyon and Wosham Creeks (Figure 9). Runoff from the Puente Hills is an expected source of increased mountain front recharge along the northeastern margin of the basin in the Whittier area.

## **2.5 Hydrogeology**

There are at least three different interpretations relating to hydrostratigraphic units in the vicinity of the LE Area as follows: the CDWR Bulletin 104 (1961); the 2010 RI Report (2010); and the USGS (2014 and on-going). Bulletin 104 focuses on identifying aquifers within the Los Angeles Basin. The 2010 RI Report builds upon Bulletin 104 and focuses on stratigraphic units that consist of a combination of coarse- and fine-grained sequences within and in the vicinity of OU2 including the LE Area. The USGS focus is on chronostratigraphic units in the Central Basin which includes age correlated units that are not necessarily tied to aquifer/aquitard sequences. All three of the interpretations incorporate some of the key geologic structural features in the vicinity of the LE Area, but differ in overall interpretation. A generalized description of the hydrostratigraphy based on Bulletin 104 nomenclature as adopted from the 2010 RI Report is presented in this Section.

The LE Area is located in the Whittier area of the Central Basin, a sub-basin of the coastal plain of Los Angeles County (CH2MHill, 2010). The coastal plain is bounded on the west and south by the Pacific Ocean and by mountains on the north, east, and southeast. The coastal plain is underlain by an extensive groundwater basin in Los Angeles and Orange Counties.

### **2.5.1 Hydrostratigraphic Units**

The following description of hydrostratigraphic units is preliminary and will be refined for the LE Area using both existing and newly acquired data collected during the LEI.

Water-bearing sediments identified in the Whittier area extend to an approximate depth of at least 1,000 ft bgs (CH2M Hill, 2010). The identified geologic units consist of recent alluvium, the upper Pleistocene Lakewood Formation, and the lower Pleistocene

San Pedro Formation. The Pliocene and Miocene marine sediments below the San Pedro Formation generally contain saline water in the Whittier area, are considered nonwater-bearing where exposed in the Puente Hills, and are not addressed in this report. Figure 10 shows a generalized stratigraphic column of fresh water- bearing sediments in the coastal plain of Los Angeles.

The shallowest hydrostratigraphic units (recent alluvium) include the semiperched aquifer, the Gaspar aquifer, and the Bellflower aquiclude (Bellflower aquitard). The Gaspar aquifer is mainly sand and gravel with a small amount of interbedded clay. The Gaspar aquifer is only found within the recent alluvium. However, the CDWR considers the semiperched aquifer and the Bellflower aquiclude to be present in both the recent alluvium and the upper part of the Lakewood Formation. The saturated portion of the Gaspar aquifer is for the most part to the west of OU2, but does extend east into OU2 in the area roughly centered about Slauson Avenue.

The Lakewood Formation consists of non-marine deposits including the Artesia and Gage aquifers. The Gage aquifer is generally present and saturated within the LE Area. The Gage aquifer does not appear to be an important source of drinking water in the Whittier area, based on elevated total dissolved solids (TDS) concentrations measured in groundwater samples collected at OU2.

The San Pedro Formation unconformably underlies the Lakewood Formation. The San Pedro Formation has been subdivided into five named aquifers separated by clay layers. A fine-grained layer is also typically present at the top of the sequence; although, in localized areas, the uppermost San Pedro Formation aquifer may be merged with the overlying aquifer, and one or more of the five aquifers may also be merged (CDWR, 1961). The five aquifers defined within the San Pedro Formation include, from top to bottom, the Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside aquifers. The Hollydale aquifer has been identified by the CDWR (1961) throughout most of the LE Area with the exception of the southeastern tip. The other aquifers within the San Pedro Formation are thought to be present over most or all of the LE Area.

### **2.5.2 Geologic Structures and Faults**

The major geologic structures in the vicinity of the LE Area include the west-northwest trending Santa Fe Springs (also named Coyote) anticline in the general area between Los Nietos Road and Telegraph Road (Figure 11) (CH2M Hill, 2010).

There are no known faults within LE Area. The Whittier and Norwalk faults are both west-northwest trending, with the Whittier fault being located to the northeast of OU2 in the Puente Hills and the Norwalk fault being located to the south of LE Area (approximately along Interstate 5).

### **2.5.3 Groundwater Levels**

The depth to groundwater at and in the vicinity of the LE Area has fluctuated over time. A water level hydrograph has been prepared for a well monitored by the Los Angeles County Department of Public Works between 1947 and 2016 (Figure 12). The water levels were highest at the start of this monitoring period and declined relatively steadily until the late 1950's, at which point the water levels were at a historical low. Following this time, which is roughly about the time the Central Basin was adjudicated, water levels recovered to some degree. Between 1970 and 2016, the water levels have fluctuated seasonally on the order of 5 to 20 feet. During this same time frame, the overall water level fluctuation has been almost 60 feet, with the high water level for the period of monitoring occurring in the mid-1990s and the low water levels occurring in 1978 and over the past several years.

The horizontal direction of groundwater flow has been evaluated by EPA in the 2010 RI and subsequent groundwater monitoring reports. Overall, the general direction of groundwater flow has been south-southeast in the LE Area. There have been shifts in the direction of groundwater flow that appear to correlate with changes in groundwater elevations.

Vertical hydraulic gradients for the LE Area have been evaluated as part of the 2010 RI and subsequent groundwater monitoring reports based on water levels measured in the MW27 monitoring well cluster. At the MW27 cluster, neutral gradients have been observed in the shallowest well pair (MW-27A/MW27B) since 2009. Downward gradients have been observed in the middle well pair (MW27B/MW27C) since 2009. The gradients in the deepest well pair (MW27C/ MW27D) are generally neutral to downward since 2009.

## **2.6 Groundwater Chemistry**

Groundwater monitoring in OU2 including the LE Area has focused on constituents that have been detected at concentrations exceeding their screening levels (maximum

contaminant levels (MCLs) and notification levels (NLs)) and have been grouped in five categories: VOCs, semi-volatile organic compounds (SVOCs), emergent compounds, metals, and general chemistry.

### **2.6.1 Constituents**

The 2011 ROD identified 13 COCs for the OU2 including the LE Area, eleven of which are VOCs (tetrachloroethene [PCE], trichloroethene [TCE], trichlorofluoromethane [Freon 11], 1,1,2-trichloro-1,2,2-trifluoroethane [Freon 113], 1,1-dichloroethene [1,1-DCE], cis-1,2-dichloroethene [cis-1,2-DCE], chloroform, carbon tetrachloride, 1,1-dichloroethane [1,1-DCA], 1,2-DCA, and 1,1,1-trichloroethane [1,1,1-TCA]); one is an inorganic constituent (hexavalent chromium) and the remaining compound is 1,4-dioxane (Table 1). These 13 COCs will be referred to as Main COCs.

### **2.6.2 Distribution**

The distribution of Main COCs within and in the vicinity of the LE Area was evaluated. The following provides a summary of the current understanding of the general distribution of Main COCs in the LE Area.

- PCE and TCE exceeded their respective MCLs within the LE Area. Both of these compounds are common solvents used/handled by many sites within or immediately adjacent to the LE Area and OU2. The detection of relatively elevated concentrations of these compounds in the LE Area, indicates the presence of source areas in the LE Area.
- Freon 11 and Freon 113 have not been detected in the LE Area above MCLs. Freon 11 and Freon 113 were known to be used by businesses in OU2 and the types of businesses known to operate currently and historically in OU2 were the types of businesses that frequently utilized Freons. Uses included dry cleaning, cold cleaning electrical parts, vapor phase cleaning, photographic film and magnetic tape cleaning, use in refrigerants, use in blowing agents, use in oil field activities, use in fire extinguishing, use in propellants, and use in oil field activities. Freon was also commonly found in both automotive and industrial waste oils. Freon 113 has been infrequently analyzed at sites within OU2 but it was commonly found in soil, soil gas, or groundwater at sites where it was analyzed. Freon 11 was more frequently analyzed and was found in at least one environmental medium at those properties where it was tested for.

- The remaining Main COC VOCs are generally within the overall extent of PCE and TCE in the LE Area.
- 1,4-Dioxane has been detected exceeding the NL over an area and depth similar to PCE and TCE, although at generally lower concentrations. This compound is often associated with 1,1,1-TCA, which has been used/handled by many sites within OU2.
- Hexavalent chromium has not been detected above the MCL of 10 µg/L at the LE Area monitoring wells (MW27 well cluster, MW28, MW29, MW30, MW32 and Koontz well cluster). The highest concentration of hexavalent chromium detected in the LE Area was 7.44 µg/L at MW32 in 2013.

At the GSWC production wells Pioneer 1, Pioneer 2, Pioneer 3 and Dace 1, which are located adjacent to the LE Area, the concentrations of PCE, TCE and 1,1 DCE have exceeded the MCLs, and the concentrations of 1,4-dioxane have exceeded the NL, while hexavalent chromium has not been detected above the MCL.

### **3. DATA QUALITY OBJECTIVES**

Data Quality Objectives (DQOs) were developed in accordance with “Guidance on Systematic Planning Using the Data Quality Objectives Process, QA/G-4, EPA/240/B-06/001” (EPA, 2006). The DQO Process is used to develop performance and acceptance criteria (or data quality objectives) that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. The steps to the DQO process are:

- Step 1 - State the problem
- Step 2 - Identify the goal of the study
- Step 3 - Identify information inputs
- Step 4 - Define the boundaries of the study
- Step 5 - Develop the analytical approach
- Step 6 - Specify performance or acceptance criteria
- Step 7 - Develop the plan for obtaining data

Project DQOs were developed as described below and are also detailed in tabular format in Table 3.

The first step of the DQO process is to identify the overall purpose of the study. The proposed investigation work described in this LEI Work Plan will include installing three additional monitoring wells with up to five screens per well to collect information on the vertical distribution of groundwater with COCs exceeding the relevant regulatory guidelines, as well as the gradients that affect the groundwater’s vertical movement. Therefore, the following problem statement was defined for the LEI:

There is a need to evaluate the groundwater chemistry and vertical gradients at three locations within the LE Area as specified in the SOW to a maximum depth of 500 ft bgs.

Based on this need, three study goals were identified as follows:

- Determine the appropriate screen intervals for the wells in each LEI monitoring well cluster.
- Characterize the vertical distribution of the COCs, including VOCs, 1,4-dioxane, and hexavalent chromium, in the LEI monitoring wells.
- Characterize the vertical groundwater gradients in the LE Area.

The following sections describe the DQO process for steps 3 through 7 for each of the study goals.

### **3.1 Determine the Appropriate Screen Intervals for the Wells in Each LEI Monitoring Well Cluster.**

Step 3 (Identify information inputs) – Selecting the appropriate screen intervals requires information on the depths of the coarser and finer grained lithologic units and the potential correlation between these units in the LE Area. The following information will be used as inputs to selecting the screen intervals:

- A lithologic log of drill cuttings from an exploratory borehole at each LEI monitoring well cluster location, including a description of the cuttings based on visual logging using the Unified Soil Classification System (USCS), and field observations of drill rig behavior including speed and drill chatter;
- Geophysical logs of an exploratory borehole at each LEI monitoring well cluster location including: natural gamma; spontaneous potential (SP), 16-inch normal resistivity, 64-inch normal resistivity, lateralog-3, and caliper/borehole volume; and
- The existing hydrogeologic conceptual site models (CSMs) including the LE Area prepared by EPA, the CDWR and the USGS.

Step 4 (Define the boundaries of the study) – The spatial boundaries for the LEI are specified in the 2016 CD and shown in Figure 2. The locations of the monitoring wells will be selected at logistically feasible locations in the LE Area within the areas for the LEI monitoring well clusters shown in Appendix C of the CD (Figure 3). Wells will be installed first in the two northernmost locations (LEI Monitoring Well Cluster 1 and LEI Monitoring Well Cluster 2). Following review of the data from these wells, and

review of approval by EPA, the third well will be installed (LEI Monitoring Well Cluster 3).

In accordance with the SOW, the LEI activities will begin upon EPA approval of this LEI Work Plan. Potential practical constraints that could limit the study boundaries were identified and include the following:

- Obtaining access and permits to drill and install the LEI monitoring wells;
- The locations of buildings and utilities; and
- City and/or county regulations on work hours.

Step 5 (Develop the analytical approach) - The following approach was developed to determine the appropriate screen intervals:

- The deepest well in LEI Monitoring Well Clusters 1 and 2 will be screened in the deepest coarse grained layer greater than 10 feet in thickness observed in the exploratory boring to a maximum depth of 500 feet. The deepest coarse grained layer will be identified by the California Professional Geologist supervising the work based on review of the exploratory boring lithologic and geophysical logs. A brief transmittal will be prepared to convey the selected well depth intervals and supporting data to EPA for review and approval.
- Up to four additional well screen intervals will be selected at each of these two LEI monitoring well clusters to be screened in the coarse grained layers between the deepest screened interval and the water table. These layers will be identified by the California Professional Geologist supervising the work based on review of the exploratory boring lithologic and geophysical logs for each LEI monitoring well cluster location and the hydrogeologic CSMs. A brief transmittal will be prepared to convey the selected well depth intervals and supporting data to EPA for review and approval.
- Following installation of LEI Monitoring Well Clusters 1 and 2 and review of the initial groundwater elevations and analytical data for COCs collected from these wells, the location of LEI Monitoring Well Cluster 3 will be proposed for EPA review and approval. The process for selecting the screened intervals for this cluster will proceed as above.

Step 6 (Specify performance or acceptance criteria) – Acceptance criteria include confirmation that field data are: (1) representative of the geophysical conditions that exist, (2) comparable to subsequent or previously collected data and consistent with the current understanding of the existing CSMs, (3) complete to the extent that necessary conclusions may be obtained, and (4) accurate at the levels that are appropriate for determining the location of coarse grained intervals for monitoring well installation. Errors will be minimized by adhering to the field quality assurance/quality control (QA/QC) protocols established in the Quality Assurance Project Plan (QAPP) (Appendix A) and Field Sampling Plan (FSP) (Appendix B).

Step 7 (Develop the plan for obtaining data) – Up to five monitoring well screen intervals at each well cluster will be selected as described above. The monitoring well depths and screen intervals will be selected to be in the coarsest grained layers between the deepest monitoring well and the water table at the respective well cluster. Geophysical logs will be used to select a screen interval for the deepest monitoring well in each well cluster. After the deepest well is installed, the geophysical and boring logs will be used to select up to four additional monitoring wells at each well cluster.

### **3.2 Characterize the Vertical Distribution of the COCs in the LEI Monitoring Wells**

Step 3 (Identify information inputs) – Groundwater monitoring activities need to include collection of groundwater samples in the LEI monitoring well clusters, laboratory analysis of the samples for COCs, and sample analytical results that can be readily compared to appropriate action levels for each COC. The action level for each COC is the EPA or State MCLs, or in the absence of an MCL, NLs established by the California State Water Resources Control Board Division of Drinking Water. More specifically, the following information would be used as inputs to determine the vertical distribution of the COCs in the LEI monitoring wells:

- Groundwater samples collected during three quarterly monitoring events following well installation for analysis of the COCs:
  - VOCs by EPA Method 8260B, including but not limited to the following:
    - TCE;
    - PCE;

- Freon 11;
- Freon 113;
- 1,1-DCE;
- cis-1,2-DCE;
- Chloroform;
- Carbon tetrachloride;
- 1,1-DCA;
- 1,2-DCA; and
- 1,1,2-TCA;
- 1,4-Dioxane by EPA Method 8270C SIM; and
- Hexavalent chromium by EPA Method 218.6;
- MCLs: TCE 5 micrograms per liter (µg/L), PCE 5 µg/L, Freon 11 150 µg/L, Freon 113 1,200 µg/L, 1,1-DCE 6 µg/L, cis-1,2-DCE 6 µg/L, chloroform 80 µg/L<sup>1</sup>, carbon tetrachloride 0.5 µg/L, 1,1-DCA 5 µg/L, 1,2-DCA 0.5 µg/L, 1,1,2-TCA 5 µg/L, and hexavalent chromium 10 µg/L; and,
- NL: 1,4-dioxane 1 µg/L.

Step 4 (Define the boundaries of the study) – The spatial boundaries for the LEI monitoring well clusters are specified in the CD and shown on Figure 3. The LEI monitoring wells will be sampled quarterly for three quarters following completion of installation and development at each well cluster.

Potential practical constraints that could limit the study boundaries were identified and include the following:

- Obtaining access to the monitoring wells;
- Damaged wells; and

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<sup>1</sup> The MCL is for total trihalomethanes which includes bromodichloromethane, bromoform, chloroform, and dibromochloromethane

- Insufficient water in wells for sampling.

Step 5 (Develop the analytical approach) – The following analytical process was developed to determine the vertical distribution of the COCs in the LEI monitoring wells:

- Samples will be collected from the LEI monitoring wells and sent to a California-certified laboratory for analysis of VOCs, 1,4-dioxane, and hexavalent chromium. The reporting limits (RLs) for the Main COCs based on the laboratory analytical methods are as follows: TCE 0.5 µg/L, PCE 0.5 µg/L, Freon 11 0.5 µg/L, Freon 113 0.5 µg/L, 1,1-DCE 0.5 µg/L, cis-1,2-DCE 0.5 µg/L, chloroform 0.5 µg/L, carbon tetrachloride 0.5 µg/L, 1,1-DCA 0.5 µg/L, 1,2-DCA 0.5 µg/L, 1,1,2-TCA 0.5 µg/L, 1,4-dioxane 1.0µg/L, and hexavalent chromium 1.0 µg/L;
- After laboratory analytical results are obtained, the laboratory data will be subjected to a Stage 2A data validation. Approximately 10% of the data received from the laboratory will be subjected to a Stage 4 data validation. The QAPP (Appendix A) provides specific procedures for the data validation and which QC elements are included in the data validation stages;
- Following QA/QC review, the concentrations of COCs in the LEI Area monitoring wells will be compared to the MCLs and NLs. The RLs are lower than the respective action level for each COC; therefore, the analytical data will be sufficient to characterize the distribution of COCs above the action levels. The analytical data will be presented in tables.

Step 6 (Specify performance or acceptance criteria) – Acceptance criteria include confirmation that laboratory data are: (1) representative of the chemical conditions that exist, (2) comparable to subsequent or previously collected data, (3) complete to the extent that necessary conclusions may be obtained, and (4) of known statistical significance in terms of precision and accuracy, at the levels that are appropriate for evaluating COC distribution. Errors will be minimized by adhering to the field QA/QC protocols established in the QAPP (Appendix A) and FSP (Appendix B).

Step 7 (Develop the plan for obtaining data) – Groundwater samples will be collected using low-flow sampling procedures with either a submersible pump or bladder pump. Each well will be purged, and field parameters will be monitored during purging.

Samples will be collected after field parameters have stabilized as described in the Water Quality Parameter Measurements Standard Operating Procedure (SOP) included in the FSP. All samples from the monitoring wells will be analyzed for VOCs by EPA Method 8260B; hexavalent chromium by EPA Method 218.6; and 1,4-dioxane by EPA Method 8270C SIM. Field and laboratory QA/QC samples will be collected and analyzed. The plan for collecting groundwater samples was developed based on the preceding steps and is outlined in Section 5.11.

### **3.3 Characterize the Vertical Groundwater Gradients in the LE Area**

Step 3 (Identify information inputs) – Determining vertical groundwater gradients requires collection of depth-to-water measurements at multiple depths and locations in the LE Area. Depth-to-water measurements are converted to groundwater elevations using the surveyed elevation of the top of the well casing. Pressure transducer data are similarly converted to groundwater elevations using the surveyed elevation of the top of the well casing with a manual water level measurement correlating to a time at which the transducer is also recording data in the well, and the depth below the potentiometric surface<sup>2</sup> at which the pressure transducer is deployed in the well. The following information will be used as inputs to determine the vertical groundwater gradients in the LE Area:

- Quarterly depth to water measurements performed in the monitoring wells in the LEI monitoring well clusters during three quarterly monitoring events;
- Top of casing point of reference elevation from surveying of the LEI monitoring wells; and
- Pressure transducer data for a period of at least one month collected from the monitoring wells in each of the LEI and Koontz monitoring well clusters.

Step 4 (Define the boundaries of the study) – The spatial boundaries for the LEI monitoring well clusters are specified in the 2016 CD and shown on Figure 3. Depth-to-water measurements will be taken quarterly in the LEI monitoring wells for three quarters following completion of installation and development at each well cluster.

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<sup>2</sup> If an unvented transducer is used then barometric pressure as measured with a separate data logger will be used to correct the groundwater elevation calculations for barometric pressure changes.

Transducers will be installed in the Koontz monitoring well cluster following EPA approval of this LEI Work Plan. The transducers will be moved from the Koontz well to the LEI monitoring well clusters following their installation. A minimum of one month of transducer data would provide sufficient data to characterize the vertical gradients in a well cluster; however, additional data may be collected during the LEI if needed to resolve apparent data discrepancies or longer term water level trends.

Potential practical constraints that could limit the study boundaries were identified and include the following:

- Obtaining access to water the monitoring wells;
- Damaged wells; and
- Insufficient water in wells for measuring water levels.

Step 5 (Develop the analytical approach) – Depths to groundwater will be measured to the nearest one hundredths of one foot (0.01 foot). Groundwater elevations will be calculated using the depth to water measurements, transducer data, and top of casing surveyed elevations for the monitoring wells. The top of casing elevations of the monitoring wells must be surveyed relative to mean sea level to the nearest 0.01 foot by a State of California Licensed Land Surveyor. Consistent with requirements for the State of California, latitude and longitude must be determined with Third Order methods using a minimum of two reference points: California Spatial Reference System Horizontal (CSRS-H) or two horizontal geodetic control points derived from the CSRS-H. Monitoring well locations must be tied into North American Datum of 1983 (NAD83) Universal Transverse Mercator (UTM) Zone 11 datum horizontally and North American Vertical Datum of 1988 (NAVD88) datum vertically. The depths to groundwater and calculated groundwater elevations in each monitoring well cluster will be compared and presented in tables and figures to evaluate the direction of the vertical gradient at each of the three well clusters in the LE Area and the Koontz well.

Step 6 (Specify performance or acceptance criteria) – Acceptance criteria include confirmation that measurements are collected accurately to within 0.01 foot by repeating the measurement at each well and preparing legible and accurate field notes. Errors will be minimized by adhering to the field QA/QC protocols established in the QAPP (Appendix A) and FSP (Appendix B).

Step 7 (Develop the plan for obtaining data) – Water levels will be measured manually using a QED®, Solinst® or comparable flat tape electric water level sounder. Pressure transducers and data loggers will also be installed and used to record water levels for a period of at least one month. The plan for collecting water level data was developed based on the preceding steps and is outlined in Sections 4.11 and 4.12.

#### **4. MONITORING WELL INSTALLATIONS**

Monitoring well clusters will be installed in the LE Area at three locations specified in the SOW. Each monitoring well cluster will include up to five monitoring wells. The deepest well installed in each well cluster will not exceed 500 ft bgs. Details of the activities to be performed are described in the following sections.

##### **4.1 Selection of Monitoring Well Locations**

The locations of the monitoring wells will be selected at logistically feasible locations within the areas for the LEI monitoring well clusters shown in Appendix C of the 2016 CD, which are displayed in Figure 3 of this LEI Work Plan. The first two monitoring well clusters will be installed within the areas labeled as 1 and 2 in Figure 3, and the third monitoring well cluster will be installed within the area labeled 3 in Figure 3. The third monitoring well cluster location will be selected based on the analytical sampling results from the first two monitoring well clusters and will be located downgradient of the monitoring well cluster with higher concentrations of COCs. If the first two monitoring well clusters have similar COC concentrations, the third well cluster will be located downgradient between the first two monitoring well clusters (Figure 3).

To determine logistically feasible locations for the monitoring well clusters, the land use, property owners, and location of utilities will be evaluated within the monitoring well cluster areas shown in Figure 3. Discussions will be held with the City of Norwalk to determine potential locations where the monitoring wells could be installed in the public right of way. For the first two monitoring well clusters, discussions may also be held with the City of Santa Fe Springs, as the proposed areas for these well clusters cross the boundary between Norwalk and Santa Fe Springs.

Utility maps will be reviewed and an Underground Service Alert (USA) may be marked at potential locations identified for the monitoring well clusters, to determine the presence and location of utilities. Private or government-owned properties may be

identified within the areas shown in Figure 3, and the property owners contacted to determine if an access agreement can be obtained to install monitoring wells on their property. The SWDs will notify EPA regarding discussions with property owners and may seek assistance from EPA in obtaining access agreements and/or permission to block driveways to conduct the LEI Work Plan activities. The SWDs will coordinate with EPA on community relation activities including providing relevant documents to EPA to prepare notification to businesses, residents, and the community prior to the start of well installation activities. If a feasible location for a monitoring well cluster cannot be identified within the areas shown in Figure 3, the closest feasible location identified will be proposed.

Once feasible locations for the first two monitoring well clusters are identified, a figure showing the proposed monitoring well locations will be provided to EPA for review and approval prior to the start of field activities. Following receipt of the analytical results from the first two monitoring well clusters, a logistically feasible location will be identified for the third monitoring well cluster. EPA will be provided with a figure showing the proposed location for the third monitoring well cluster for review and approval prior to the start of installation activities for the third well cluster.

#### **4.2 Permitting**

The following permitting activities will be conducted prior to fieldwork:

- Well installation drilling permits will be obtained from the Los Angeles County Department of Public Health; and
- If the wells are installed within the city limits of Norwalk or Santa Fe Springs in public rights of way, traffic control plans will be developed, and encroachment permits will be obtained from the appropriate city. Traffic control plans developed will include appropriate provisions for signage, lane closure, and egress into driveways, as necessary.

#### **4.3 Health and Safety**

Prior to field activities, the Health and Safety Plan (HASP) provided in Appendix C will be updated for LEI field activities. A safety tailgate meeting will be conducted every day prior to the start of field activities, and the HASP will be available onsite during all LEI field activities. All contractors selected to conduct the LEI fieldwork will prepare

their own HASPs to encompass their individual field activities. A template for the HASP is provided in Appendix C.

#### **4.4 Underground Utility Clearances**

The following activities will be conducted to assess the approved drilling locations for utilities:

- The exploratory borings and well locations will be marked with white paint;
- USA will be notified at least 48 hours prior to commencement of drilling activities; and
- A private utility locator will perform physical surveys to clear potential subsurface utilities, pipelines, or other obstructions prior to drilling work.

#### **4.5 Exploratory Borings**

One exploratory boring will be drilled to 500 ft bgs at each of the first two well cluster locations by a C-57 licensed drilling contractor using the mud rotary drilling method. This method was selected based on the depth of the wells and to facilitate geophysical logging. The field procedures for drilling are detailed in the FSP included as Appendix B. An exploratory boring at the third well cluster will be drilled subsequent to the installation and sampling of the monitoring wells at the first two well cluster locations.

##### **4.5.1 Lithologic Logging**

A log of each boring will be prepared by field personnel under the supervision of a California Professional Geologist. The log will document drilling operations and observations of soil cuttings from the mud circulation. Soil cuttings collected from the exploratory borings will be visually logged using the USCS following the field procedures outlined in the FSP (Appendix B). As described in the FSP, samples of the drilling mud with entrained soil cuttings will be collected and the drilling mud decanted away prior to the soil cuttings being visually logged.

##### **4.5.2 Geophysical Logging**

Downhole geophysical logs will be conducted in the exploratory borehole at each well cluster location to the total boring depth. The suite of geophysical logs will include:

natural gamma; SP, 16-inch normal resistivity, 64-inch normal resistivity, lateralog-3, and caliper/borehole volume. The lithologic and geophysical logs will provide the basis for the screened intervals for the monitoring wells in each cluster. Details on the geophysical logging procedures are outlined in the FSP (Appendix B).

#### **4.6 Selection of Screen Intervals and EPA Approval Process**

The lithologic and geophysical logging of the exploratory borings will be used to select the well depths and screen intervals for up to five monitoring wells at each well cluster following the procedures outlined in the FSP (Appendix B). Each monitoring well will have a screen interval between 10 and 20 feet in length. The monitoring well depths and screen intervals will be placed in the coarsest grained layers that correlate with layers screened at the Koontz wells.

After completion of the geophysical logging at each exploratory boring, the geophysical logs will be used to select a screen interval for the deepest monitoring well in the well cluster such that it is screened in the deepest coarse grained layer observed. The SWDs will provide EPA with the selected screen interval along with the geophysical log and the field boring log. The selected screen interval will be finalized within 24 hours of providing information to EPA, during which period the SWDs will be available to confer with EPA regarding the screen interval of the deepest monitoring well in the cluster. Following the geophysical logging, the exploratory borehole will be reamed and upon finalizing the screen interval, the deepest monitoring well will be installed in the exploratory borehole.

After the deep well installation is complete at the first two monitoring well clusters, the geophysical logs and boring logs will be reviewed in relationship to existing available data and geologic reports. Based on this review, the SWDs will propose screen intervals for up to four additional monitoring wells at each of the two well clusters. A brief transmittal will be prepared to convey the selected well depth intervals and supporting data to EPA. It is anticipated that a meeting or conference call will be held with EPA to discuss the proposed screen intervals. Following EPA's review and approval of the proposed screen intervals, the remaining monitoring wells in each well cluster will be installed.

The location of the third well cluster will be finalized following review of chemistry and water level data collected from the first two well clusters. The SWDs will provide

EPA with the data and a recommendation for the location. Following EPA review and approval, the well cluster will be installed at the selected location.

After the deepest well is installed at the third cluster location, the geophysical log and boring log will be reviewed in relation to the information from the first two well clusters. Based on this review, the SWDs will propose screen intervals for up to four additional monitoring wells at this cluster. A brief transmittal will be prepared to convey the selected well depth interval and supporting data to EPA. Similar to the first two well clusters, it is anticipated that a meeting or conference call will be held with EPA to discuss the proposed screen intervals. Following EPA's review and approval of the proposed screen intervals, the remaining monitoring wells in the third cluster will be installed.

#### **4.7 Well Installation Details**

Each monitoring well will be installed in a separate borehole. The deepest monitoring well will be installed in the exploratory borehole using the mud rotary drilling method. The shallower monitoring wells in each well cluster will be installed using the sonic drilling method. If refusal is encountered with sonic drilling, the well will be installed using the mud rotary drilling method.

The monitoring wells will be installed to the selected depths as described in Section 5.6. Once the total depth of each boring is reached, the monitoring well will be constructed through the center of the drilling pipe.

Logging of the boreholes and construction of the monitoring wells will follow the procedures provided in the FSP (Appendix B). The monitoring well casings will consist of 4-inch nominal diameter schedule 80 polyvinyl chloride (PVC) pipe, with 0.020-inch slotted well screen, flush-threaded joints and a bottom cap. Centralizers will be installed at 40-foot intervals along blank casing. A filter pack consisting of Monterey sand no finer than Lonestar No. 1C, will be installed in the annulus between the borehole and the well screen from the total depth of the well to approximately 3 to 5 feet above the top of the screened interval. An approximate 2- to 3-foot thick bentonite seal will be emplaced in the annulus above the filter pack using bentonite pellets. Sufficient time will be allowed for the bentonite to hydrate prior to grouting the remaining annulus. The annulus between the borehole and well casing will be grouted from the top of the bentonite seal to approximately 2 to 3 ft bgs using bentonite-cement (up to 5 percent bentonite) mixture, or

neat cement. The cement will be tremied down the annular space of the borehole to ensure a competent surface seal. The surface completion will consist of either an above-grade 'stove pipe' casing or a flush-mount traffic-rated well box, depending on the well location.

Well installation soil cuttings, mud, and water generated during the field investigation activities will be stored in a series of leak-resistant roll-of bins and water tanks prior to disposal as discussed in Section 4.9 and the FSP (Appendix B).

#### **4.8 Well Development**

Well development will be conducted at the newly installed monitoring wells to establish better hydraulic communication with groundwater in the surrounding formation in accordance with the procedures described in the FSP (Appendix B). After a minimum of 72 hours following each well installation, the new monitoring wells will be developed. Development will consist of a combination of bailing, surging, and pumping. Groundwater quality parameters (temperature, pH, specific conductance, and turbidity) will be measured during purging activities. The wells will be developed to remove the fine-grained materials inside the filter pack and casing, to stabilize the filter pack around the well screen, and to produce representative water samples from the water-bearing zone.

The well development will be continued until the field personnel under the supervision of a California Licensed Professional Geologist, determines the well has been sufficiently developed (EPA, 2001).

Well development water will be stored in a series of water tanks prior to disposal as described in Section 4.9 and the FSP (Appendix B).

#### **4.9 Investigation-Derived Waste Storage and Disposal**

All IDW generated from groundwater sampling activities described in this LEI Work Plan will be containerized, properly labeled, and temporarily stored at an appropriate location to be determined within the Work Area. Samples will be collected for waste profiling and sent to a California-certified laboratory for analysis in accordance with California Code of Regulations, Title 22, Section 66261.24. Following waste profiling, the IDW will be transported by a licensed waste hauler for disposal at an appropriately permitted solid or hazardous waste facility in accordance with Federal and State

requirements. IDW will be stored for no more than 60 days during characterization and consolidation. Handling of investigation derived waste is described in Section 11 of the FSP (Appendix B).

#### **4.10 Surveys**

Upon completion of well installation activities, the location and top of casing elevations of the new monitoring wells will be surveyed by a State of California Licensed Land Surveyor. The top of casing elevations for the wells will be surveyed relative to mean sea level, and subsequent measurements of depth to water will be referenced to these data. Surveying procedures will follow the details provided in Section 7 of the FSP (Appendix B).

#### **4.11 Monitoring Well Sampling and Water Level Measurements**

In accordance with the SOW, groundwater chemistry and water level data will be collected from each monitoring well in the LEI well clusters following installation and quarterly for three subsequent quarters after the initial sampling event. Once this year of data collection is complete, the LEI well clusters will be incorporated into the Work Area Monitoring Plan (WAMP) (Geosyntec 2016). Sampling analytes and water level measurement and sampling procedures are further described in the FSP (Appendix B).

Low-flow sampling procedures will be used to collect groundwater samples at the monitoring wells in accordance with the purging and sampling procedures described in the FSP. Quality control samples will also be collected as described in the FSP.

The samples will be sent to a California-certified laboratory for analysis of VOCs, 1,4-dioxane and hexavalent chromium in accordance with the methods and procedures described in the FSP.

#### **4.12 Transducers**

Five pressure transducers will be installed to monitor groundwater elevations in LE Area wells. At the Koontz well cluster and at each of the LEI well clusters, the water levels will be monitored with pressure transducers for a period of at least one month. The pressure transducers will be installed in accordance with the procedures described in the FSP (Appendix B).

Prior to installation of the LEI monitoring wells, the pressure transducers will be temporarily installed in the five monitoring wells in the Koontz well cluster to record water level data. Following the installation and development of the first LEI monitoring well cluster, the pressure transducers will be downloaded and removed from the Koontz well cluster and installed into the first LEI well cluster. After a minimum of one month of monitoring, the transducers will be downloaded and moved to the second LEI well cluster. Once the installation and development of the third LEI well cluster is complete, the pressure transducers will be downloaded and moved into the third LEI well cluster.

## **5. SCHEDULE AND REPORTING**

In accordance with Section 5.1 (a) in the SOW, the LEI activities will begin upon EPA approval of this LEI Work Plan. Following installation, the monitoring wells in the LEI well clusters will be monitored for three quarters and incorporated into the WAMP (Section 4.11). The project schedule is shown in Figure 13.

Within 60 days of completing all LEI field activities described in this work plan, including well installation, development, water level monitoring with transducers, well surveying, and three quarters of sampling, the SWDs will submit a LEI Evaluation Report to EPA. In accordance with the SOW, the LEI Evaluation Report will include the following:

- A summary of the investigation activities performed;
- A summary of investigation results, including a summary of validated data (i.e., tables and graphics), the results of the data analyses, and a narrative interpretation of data and results;
- Data validation reports and laboratory reports; and
- Conclusions.

## **6. REFERENCES**

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- EPA, 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4. February.
- EPA, 2016. Consent Decree regarding Operable Unit 2 at the Omega Chemical Corporation Superfund Site, Case 2:16-cv-02696 Document 4-1. Filed with United States District Court, Central District of California, Western Division. April 20, 2016.
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## TABLES

TABLE 1

## Main Compounds of Concern

Main Compounds of Concern (COCs)	
Volatile Organic Compounds	Trichloroethene (TCE)
	Tetrachloroethene / Perchloroethene (PCE)
	Trichlorofluoromethane (Freon 11)
	1,1,2-Trichloro-1,2,2,-trifluoroethane (Freon 113)
	1,1-Dichloroethene (1,1-DCE)
	cis-1,2-Dichloroethene (cis-1,2-DCE)
	chloroform
	carbon tetrachloride
	1,1-Dichloroethane (1,1-DCA)
	1,2-Dichloroethane (1,2-DCA)
	1,1,2-Trichloroethane (1,1,2-TCA)
Other	1,4-dioxane
	hexavalent chromium

TABLE 2

## SUPPLEMENTAL OU2 SOURCE IDENTIFICATION, LEADING EDGE INVESTIGATION WORK AREA VICINITY

MAP ID	DATABASE <sup>1,2</sup>	DATABASE ID	SITE NAME	ADDRESS
1	Geotracker	T10000004356	7 ELEVEN RETAIL CONVENIENCE STORE	13203 TELEGRAPH ROAD, SANTA FE SPRINGS
2	Geotracker	T10000006363	76 FUEL STATION	11651 TELEGRAPH RD, SANTA FE SPRINGS
3	Envirostor	71003644	ACCURIDE INTERNATIONAL	12311 SHOEMAKER AVENUE, SANTA FE SPRINGS
4	Geotracker	SL2041J1510	ALEXANDER BELL PROPERTY	10025 BLOOMFIELD AVE, NORWALK
5	Envirostor	71003584	ALL BLACK CO.	13090 PARK STREET, SANTA FE SPRINGS
6	Other	NA	AMITY INC	10926 PAINTER AVE, SFS CA 90670
7	Envirostor	19750080	ATLAS RADIATOR, INCORPORATED	10110 NORWALK BLVD, SANTA FE SPRINGS
8	Other	NA	B&R FINISHING CO	13560 TELEGRAPH RD, WHITTIER, CA 90605
9	Geotracker	T0603701550	BAKER PETROLITE CORPORATION (same address as Baker Performance Chemicals)	11808 BLOOMFIELD AVE S, SANTA FE SPRINGS
10	Geotracker	T0603701563	BALBOA-PACIFIC BUSI.(FORMER)	11240 BLOOMFIELD AVE, SANTA FE SPRINGS
11	Both	60000159	BEAUMON TRUST PROPERTY	12525 PARK AVENUE, SANTA FE SPRINGS
12	Geotracker	T0603799560	BLOOMFIELD BUSINESS CENTER	11020 BLOOMFIELD, SANTA FE SPRINGS
13	Other	NA	BRENNTAG PACIFIC	10747 PATTERSON PLACE SFS, CA 90670
14	Geotracker	T0603701574	BROTHERS AUTO	10801 NORWALK BLVD, SANTA FE SPRINGS
15	Both	T0603703121	CALIFORNIA INDUSTRIAL PRODUCTS	11525 SHOEMAKER AVE, SANTA FE SPRINGS
16	Geotracker	T0603704082	CAMALL TRUCKING	11333 GREENSTONE AVE, SANTA FE SPRINGS
17	Geotracker	T0603702916	CERRITOS YARD	12015 SHOEMAKER AVE, SANTA FE SPRINGS
18	Geotracker	T0603705255	CERTIFIED LIFE TRUCK CO	10105 SHOEMAKER AVE, SANTA FE SPRINGS
19	Geotracker	T0603705376	CHARLES L GODBEY	10840 NORWALK BLVD S, SANTA FE SPRINGS
20	Geotracker	SLT43363361	CHEVRON - CONARD SITE	SHOEMAKER AVE, SANTA FE SPRINGS
21	Geotracker	T0603702757	CHEVRON #9-5306	12155 TELEGRAPH RD, SANTA FE SPRINGS
22	Geotracker	T0603705030	CIRCLE K LIC DEPT #3064	11462 SLAUSON AVE E, SANTA FE SPRINGS
23	Geotracker	T0603791333	CIRCLE K STORE #5234	12105 PIONEER BLVD S, NORWALK
24	Geotracker	T0603703815	CITY OF NORWALK	12700 NORWALK BLVD S, NORWALK
25	Geotracker	T0603702900	CITY OF NORWALK MAINT. YARD	12735 CIVIC CENTER DR, NORWALK
26	Envirostor	19070002	CITY OF NORWALK TRANSPORTATION YARD	12737 CIVIC CENTER DRIVE, NORWALK
27	Geotracker	T0603705258	CITY OF SANTA FE SPRINGS	11400 GREENSTONE, SANTA FE SPRINGS
28	Geotracker	SLT43106104	CITY OF SANTA FE SPRINGS	BLOOMFIELD AVE, SANTA FE SPRINGS
29	Geotracker	T0603703656	CITY OF SANTA FE SPRINGS F.D.	11736 TELEGRAPH RD E, SANTA FE SPRINGS
30	Geotracker	T10000004897	CITY OF SANTA FE SPRINGS FIRE-RESCUE	11300 GREENSTONE AVE, SANTA FE SPRINGS
31	Geotracker	T0603704370	CON'S WOOD PRODUCTS (FORMER)	11831 SHOEMAKER AVE, SANTA FE SPRINGS
32	Geotracker	T0603703210	CON-WAY WESTERN EXPRESS LK #2	12903 LAKELAND RD E, SANTA FE SPRINGS
33	Geotracker	T0603702731	COPP PAVING CO.	11927 GREENSTONE AVE S, SANTA FE SPRINGS
34	Geotracker	T0603703239	FETTER'S TRANSPORTATION	11910 GREENSTONE AVE S, SANTA FE SPRINGS
35	Geotracker	T0603703125	FIRESTONE	12225 IMPERIAL HWY E, NORWALK
36	Geotracker	SL0603744531	FORMER RIVERSIDE STEEL SITE	11401 GREENSTONE AVENUE, SANTA FE SPRINGS
37	Envirostor	71003318	GALAXY BRAZING CO., INC. - SANTA FE SPRINGS	10015 FREEMAN AVENUE, SANTA FE SPRINGS
38	Geotracker	T0603701573	GEMINIS PROPERTY DEVELOPMENT	11212 NORWALK S, SANTA FE SPRINGS
39	Geotracker	T0603793031	GOLDEN SHELL	12843 NORWALK BLVD S, NORWALK
40	Both	SL2045G1620	HALLIBURTON ENERGY SERVICES (FORMER)	12320 SOUTH BLOOMFIELD AVE, SANTA FE SPRINGS
41	Geotracker	T0603703235	HERITAGE CORPORATE CENTER	10445 NORWALK BLVD S, SANTA FE SPRINGS
42	Geotracker	T0603704155	IBM BUILDING	12501 IMPERIAL HWY E, NORWALK
43	Envirostor	19240002	IMPERIAL ANCHOR PALLET	12246 PARK AVENUE, SANTA FE SPRINGS

TABLE 2

## SUPPLEMENTAL OU2 SOURCE IDENTIFICATION, LEADING EDGE INVESTIGATION WORK AREA VICINITY

MAP ID	DATABASE <sup>1,2</sup>	DATABASE ID	SITE NAME	ADDRESS
44	Other	NA	IMPERIAL HONING	10030 GREENLEAF AVE, SFS CA 90670
45	Geotracker	SLT43330328	JOHN ALEXANDER CO.	12040 E. FLORENCE AVE, SANTA FE SPRINGS
46	Envirostor	19820103	JOHN GLENN HIGH SCHOOL EXPANSION	13520 SHOEMAKER AVENUE, NORWALK
47	Geotracker	T10000004450	Kalico Dump No. 1	11921 Shoemaker, Santa Fe Springs
48	Geotracker	T0603703627	KEDDAWAY TRUCK LINES	12133 GREENSTONE AVE S, SANTA FE SPRINGS
49	Envirostor	60000424	KELLY PIPE CO., LLC	11700 BLOOMFIELD, SANTA FE SPRINGS
50	Geotracker	T0603703236	KEYSTONE FORD	11729 IMPERIAL HWY E, NORWALK
51	Geotracker	T0603703016	K-MART	13131 TELEGRAPH RD E, SANTA FE SPRINGS
52	Envirostor	19830006	LA CTRS FOR ALCOHOL AND DRUG ABUSE	11015 BLOOMFIELD AVENUE, SANTA FE SPRINGS
53	Envirostor	60000908	LAKEVIEW PARK RECREATION FACILITY	JOSLIN STREET AND JERSEY AVENUE, SANTA FE SPRINGS
54	Other	NA	LEWIS INDUSTRIES	10024 GEARY AVE, SFS CA 90670
55	Envirostor	19281191	LIFE PAINT COMPANY	12911 SUNSHINE AVENUE, SANTA FE SPRINGS
56	Geotracker	T0603704049	LITTLE LAKE CITY SCHOOL DIST.	10515 PIONEER BLVD S, SANTA FE SPRINGS
57	Other	NA	LITTLE LAKE DEVELOPMENT	12046 FLORENCE AVE, SFS CA 90670
58	Envirostor	71003793	LOS ANGELES SERVICE CENTER	9920 FREEMAN AVE, SANTA FE SPRINGS
59	Geotracker	T0603704018	MC MULLEN OIL COMPANY	10530 SHOEMAKER AVE, SANTA FE SPRINGS
60	Geotracker	SLT4305351	MCGRANAHAM COMMERCE CTR II	BLOOMFIELD AVE, SANTA FE SPRINGS
61	Geotracker	T0603702703	MOBIL #11-F20	12616 IMPERIAL HWY, NORWALK
62	Geotracker	T0603704599	MONTGOMERY WARDS	12051 IMPERIAL HWY E, NORWALK
63	Other	NA	MOTORCAR PARTS & ACCESSORIES	10430 SLUSHER DR, SFS CA 90670
64	Geotracker	SL0603746411	NIXON-EGLI EQUIPMENT	12030 CLARK ST, SANTA FE SPRINGS
65	Envirostor	19280515	NO (SAME ADDRESS AS NEVILLE CHEMICAL)	12800 IMPERIAL HWY, SANTA FE SPRINGS
66	Envirostor	80000086	NORWALK AF POL DISTRICT	, NORWALK
67	Geotracker	SL2046D1645	NORWALK, CITY OF	13900 NORWALK BLVD, NORWALK
68	Other	NA	P&B MANUFACTURING	12131 SHOEMAKER AVE, SFS CA 90670
69	Other	NA	PALACE CLEANERS	12307 NORWALK BLVD, NORWALK, CA
70	Geotracker	T10000001907	PEDCO	9911 NORWALK, SANTA FE SPRINGS
71	Envirostor	19340724	PLATE SHOP, THE	10701 FOREST STREET, SANTA FE SPRINGS
72	Both	SL204751665	PMC SPEC INC	10051 ROMANDEL AVENUE, SANTA FE SPRINGS
73	Geotracker	T0603704732	PMC SPECIALTIES	10733 PAINTER AVE S, SANTA FE SPRINGS
74	Envirostor	19300236	POLYMER CONCEPTS	12830 IMPERIAL HIGHWAY, SANTA FE SPRINGS
75	Geotracker	T0603705249	PORVENE MCKEE	12740 LAKELAND RD, SANTA FE SPRINGS
76	Other	NA	PRECISION CONTROL FINISHING	12150 S. BLOOMFIELD AVE, SFS CA 90670
77	Envirostor	71002884	PRECISION TUBE BENDING	13626 TALE STREET, SANTA FE SPRINGS
78	Envirostor	60000466	PRODUCTOL, INC.	10051 ROMANDEL AVE., SANTA FE SPRINGS
79	Geotracker	T0603704224	RAMCO FIRE PROTECTION	13105 LAKELAND RD, SANTA FE SPRINGS
80	Geotracker	T0603702796	REBAR ENGINEERING, INC.	10706 PAINTER AVE S, SANTA FE SPRINGS
81	Envirostor	19340776	REGIONAL PUBLIC SAFETY TRAINING CENTER	11400 GREENSTONE AVENUE, SANTA FE SPRINGS
82	Envirostor	60002148	REGIONAL PUBLIC SAFETY TRAINING CENTER PARCEL #2	11400 SHOEMAKER AVENUE, SANTA FE SPRINGS
83	Geotracker	T0603701577	S E PIPELINE CONSTRUCTION CO	11832 BLOOMFIELD AVE, SANTA FE SPRINGS
84	Geotracker	T0603703432	SHELL #204-5472-0309	11755 IMPERIAL BLVD E, NORWALK
85	Geotracker	T0603701568	SHELL #204-6960-0405	13203 TELEGRAPH RD E, SANTA FE SPRINGS
86	Geotracker	T0603796891	SHELL SERVICE STATION	11755 IMPERIAL HWY., NORWALK
87	Geotracker	T0603704257	SILVEY TRANSPORTATION (FORMER)	12027 GREENSTONE AVE, SANTA FE SPRINGS

TABLE 2

## SUPPLEMENTAL OU2 SOURCE IDENTIFICATION, LEADING EDGE INVESTIGATION WORK AREA VICINITY

MAP ID	DATABASE <sup>1,2</sup>	DATABASE ID	SITE NAME	ADDRESS
88	Envirostor	71002233	SONIC PLATING CO., INC. - SANTA FE SPRINGS	13002 LOS NIETOS ROAD, SANTA FE SPRINGS
89	Geotracker	T0603704058	SOUTH PACIFIC STEEL	9835 SANTA FE SPRINGS RD, SANTA FE SPRINGS
90	Geotracker	T0603705286	SOUTH WHITTIER SCHOOL DISTRICT	10120 PAINTER AVE, SANTA FE SPRINGS
91	Other	NA	SPACE AGE CHEMICALS	13009-G LOS NIETOS RD, SFS CA 90670
92	Envirostor	19990018	STANKOVICH II	12601 BLOOMFIELD, SANTA FE SPRINGS
93	Geotracker	SLT43332330	STATE FARM INSURANCE	GEARY AVE, SANTA FE SPRINGS
94	Geotracker	T0603703930	STEEL FORM CONTRACTING	12021 SHOEMAKER AVE S, SANTA FE SPRINGS
95	Geotracker	T0603704722	STRECKER CONSTRUCTION CO	11922 BLOOMFIELD AVE, SANTA FE SPRINGS
96	Geotracker	T0603703612	SUNRISE LANDSCAPE	12542 CLARK AVE, SANTA FE SPRINGS
97	Geotracker	T0603704119	SUPERIOR OIL TOOL	12180 FLORENCE AVE E, SANTA FE SPRINGS
98	Geotracker	SLT4L1961777	TORCO USA LUBRICANT (FORMER)	12247 LAKELAND ROAD, SANTA FE SPRINGS
99	Geotracker	T0603705012	TOSCO - 76 STATION #6916 (FORMER)	12205 IMPERIAL HWY E, NORWALK
100	Both	19280771	TOXO SPRAY DUST COMPANY	12651 LOS NIETOS ROAD, SANTA FE SPRINGS
101	Geotracker	T0603703940	TRANSIT MIXED CONCRETE COMPANY	12222 FLORENCE AVE E, SANTA FE SPRINGS
102	Envirostor	71003689	TRIDENT PLATING, INC.	10046 ROMANDEL AVENUE, SANTA FE SPRINGS
103	Envirostor	71002926	TROJAN BATTERY CO. - CLARK ST FAC	12380 CLARK STREET, SANTA FE SPRINGS
104	Geotracker	SLT43365363	UNOCAL - CENTRAL S.F.S.O.F.	12404 MCCANN DR, SANTA FE SPRINGS
105	Geotracker	T0603703176	UNOCAL #5435	11651 TELEGRAPH RD, SANTA FE SPRINGS
106	Envirostor	19290245	WALKER PROPERTIES	SW CORNR OF BLOOMFIELD AVE & LAKELAND RD, SANTA FE SPRINGS
107	Geotracker	T0603703246	WALKER-TURNER PROPERTY	SW CORNR OF BLOOMFIELD AVE & LAKELAND ROAD, SANTA FE SPRINGS
108	Geotracker	T0603701570	WASTE MANAGEMENT PORTABLES	10600 PAINTER AVE, SANTA FE SPRINGS
109	Other	NA	WESTERN ALLIED	12046 E FLORENCE AVE, SFS CA 90670
110	Other	NA	WHITING ENTERPRISES	10140 ROMANDEL AVE, SFS CA 90670
111	Envirostor	19270327	WHITTIER ENGRAVING COMPANY	12631, 12633, 12637 LOS NIETOS ROAD, SANTA FE SPRINGS
112	Envirostor	80001174	WILSHIRE OIL CO.	, SANTA FE SPRINGS
113	Geotracker	T0603704169	WMC GRINDING	11813 SHOEMAKER AVE, SANTA FE SPRINGS
114	Geotracker	SLT4L7671866	YELLOW FREIGHT SYSTEMS	12250 EAST CLARK AVE., SANTA FE SPRINGS
115	Geotracker	SLT4304644	YOZYA MANAGEMENT	10600 SHOEMAKER AVE, SANTA FE SPRINGS

<sup>1</sup> Geotracker, Envirostor or Both: Downloaded databases on July 11, 2016 from followings sites: [http://geotracker.waterboards.ca.gov/data\\_download.asp](http://geotracker.waterboards.ca.gov/data_download.asp) and [http://www.envirostor.dtsc.ca.gov/public/data\\_download.asp](http://www.envirostor.dtsc.ca.gov/public/data_download.asp). Note: did not include source/potential source sites that were outlined in Remedial Investigation (RI) Report (CH2M Hill, 2010), refer to document text for listing of RI Report sources/potential sources.

<sup>2</sup> Other sites identified based on review of historical state and local agency records including but not limited to the South Coast Air Quality Management District, the Los Angeles Department of Public Works, the Santa Fe Springs Fire Department, the Los Angeles County Fire Department, the Santa Fe Springs Fire Department, the Los Angeles County Fire Department, the Los Angeles County Engineer.

NA Not applicable

Table 3 - Data Quality Objectives for Leading Edge Investigation  
Omega Superfund Site  
Operable Unit 2

Step 1 - Problem Statement / Objective		There is a need to evaluate the groundwater chemistry and vertical gradients at three locations within the LE Area as specified in the SOW to a depth of 500 feet bgs.			
Step 2 - Principal Study Goals	Principal Study Goals	1. Determine the appropriate screen intervals for the wells in each LEI monitoring well cluster.	2. Characterize the vertical distribution of COCs in the LEI monitoring wells.	3. Characterize the vertical groundwater gradients in the LE Area.	
	Potential Outcomes	Select up to five screen interval depths for the installation of monitoring wells at each LEI monitoring well cluster location	Collect samples for laboratory analysis to obtain COC data from the LEI monitoring wells to further characterize the vertical extent of COCs in the LE Area	Measure groundwater elevations in the LEI monitoring wells and Koontz Well to evaluate the vertical gradients at each monitoring well cluster	
Step 3 - Inputs to the Decision	Needed Information	Lithologic logs including field observations of drill rig behaviors and geophysical logs; natural gamma; spontaneous potential, 16-inch normal resistivity, 64-inch normal resistivity, lateralog-3, and caliper/borehole volume at an exploratory boring at each LEI monitoring well cluster location. The existing hydrogeologic CSMs including the LE area prepared by EPA, DWR, and USGS.	Analytical data of COC concentrations at LEI monitoring wells including: TCE, PCE, Freon 11, Freon 113, 1,1-DCE, cis-1,2-DCE, chloroform, carbon tetrachloride, 1,1-DCA, 1,2-DCA, 1,1,1-TCA, 1,4-dioxane, and hexavalent chromium.	Depth to water and top of casing point of reference elevation at LEI monitoring wells and Koontz Well	
	Source of Needed Information or Data	Field notes on lithologic logging of borings at LEI monitoring well cluster locations. Geophysical logs of the exploratory boring at each LEI well cluster location.	Groundwater samples collected for three quarterly monitoring events from LEI monitoring wells following installation	Depth to water measurements performed in the LEI monitoring well clusters during three quarterly monitoring events following installation. Water levels collected with transducer data for a period of at least one month in the LEI monitoring well clusters and the Koontz well cluster.	
	Action Levels	NA	MCLs: TCE (5µg/L), PCE (5µg/L), Freon 11 (150µg/L), Freon 113 (1,200µg/L), 1,1-DCE (6µg/L), cis-1,2-DCE (6µg/L), chloroform (80µg/L*), carbon tetrachloride (0.5µg/L), 1,1-DCA (5µg/L), 1,2-DCA (0.5µg/L), 1,1,1-TCA (200µg/L), and hexavalent chromium (10µg/L) NL: 1,4-dioxane (1µg/L)	NA	
	Field Methods	Lithologic logging of drill cuttings. observations of drill rig behavior including speed and drill chatter, and geophysical logging	Groundwater sampling from LEI monitoring wells	Water level measurements and surveying at LEI monitoring wells	Collection of pressure transducer data and surveying at LEI monitoring wells
	Analytical Methods	Geophysical logs: natural gamma; spontaneous potential, 16-inch normal resistivity, 64-inch normal resistivity, lateralog-3, and caliper/borehole volume	VOCs by EPA Method 8260B Hexavalent chromium by EPA Method 218.6 1,4-dioxane by EPA Method 8270C SIM	NA	

Table 3 - Data Quality Objectives for Leading Edge Investigation  
Omega Superfund Site  
Operable Unit 2

Step 4 - Study Boundaries	<u>Target Population</u>			
	Coarse grained depth intervals up to 500 ft bgs in the LEI monitoring well cluster locations	Three LEI monitoring well clusters that will characterize the distribution of contaminated groundwater in the LE Area up to 500 feet bgs. Groundwater samples will be collected in a sufficient volume to analyze for compounds and constituents listed in Step 3.	The three LEI monitoring well clusters for three quarters of water level measurements and the LEI and Koontz well cluster for transducer data collection.	
	<u>Spatial Boundaries</u>			
	The spatial boundaries for the LEI are specified in Attachment C of the Consent Decree. Monitoring wells and depths to be monitored include three new well clusters installed as part of the LEI, all screened intervals up to a depth of 500 feet.			
	<u>Temporal Boundaries</u>			
	To be initiated upon EPA approval of the LEI Work Plan	To be initiated upon completion of installation and development at each LEI monitoring well cluster and conducted for three quarters.	To be initiated upon completion of installation and development at each LEI monitoring well cluster. Water level measurements to be conducted for three quarters.	To be initiated upon EPA approval of the LEI work plan. Each well cluster to be monitored for a period of at least one month.
	<u>Potential Practical Constraints</u>			
	Obtaining access and permits to drill and install the LEI monitoring wells, the locations of buildings and utilities, city and/or county regulations on work hours	Well access constraints, damaged wells, insufficient water in wells for sampling		
Step 5 - Decision Rules/Analytic Process	<u>Parameter that Characterizes Population of Interest</u>			
	The parameters that characterize the population of interest are individual data points (water levels and COC concentrations) measured at LEI monitoring wells			
	<u>Action Levels for Study</u>			
	NA	Action levels are presented in Step 3.	NA	
	<u>Reporting Limits</u>			
	NA	The reporting limits are lower than the action levels (Step 3). TCE (0.50µg/L), PCE (0.50µg/L), Freon 11 (0.50µg/L), Freon 113 (0.50µg/L), 1,1-DCE (0.50µg/L), cis-1,2-DCE (0.50µg/L), chloroform (0.50µg/L), carbon tetrachloride (0.50µg/L), 1,1-DCA (0.50µg/L), 1,2-DCA (0.50µg/L), 1,1,1-TCA (0.50µg/L), 1,4-dioxane (1.0µg/L), and hexavalent chromium (1.0µg/L)	NA	

Table 3 - Data Quality Objectives for Leading Edge Investigation  
Omega Superfund Site  
Operable Unit 2

	<i><u>Analytic Process/Decision Rule</u></i>		
<b>Step 5 - Decision Rules/Analytic Process (continued)</b>	<p>The deepest well in LEI Monitoring Well Clusters 1 and 2 will be screened in the deepest coarse grained layer greater than 10 feet in thickness observed in the exploratory boring to a maximum depth of 500 feet. The deepest coarse grained layer will be identified by the California Professional Geologist supervising the work based on review of the exploratory boring lithologic and geophysical logs. A brief transmittal will be prepared to convey the selected well depth intervals and supporting data to EPA for review and approval.</p> <p>Up to four additional well screen intervals will be selected at each of these two LEI monitoring well clusters to be screened in the coarse grained layers. These layers will be identified by the California Professional Geologist supervising the work based on review of the exploratory boring lithologic and geophysical logs for each LEI monitoring well cluster location and the hydrogeologic CSMs. A brief transmittal will be prepared to convey the selected well depth intervals and supporting data to EPA for review and approval.</p> <p>Following installation of LEI Monitoring Well Clusters 1 and 2 and review of the data collected from these wells, the location of LEI Monitoring Well Cluster 3 will be proposed for EPA review and approval. The process for selecting the screened intervals for this cluster will proceed as above.</p>	Concentrations of COCs for the monitoring wells in the three LEI monitoring well clusters will be compared to MCLs and NLs (Step 3).	Groundwater elevations for the monitoring wells in the three LEI monitoring well clusters will be presented in tables and figures.
<b>Step 6 - Tolerable Limits on Decision Rules</b>	Acceptance criteria include confirmation that field data are: (1) representative of the geophysical conditions that exist, (2) comparable to subsequent or previously collected data and consistent with the current understanding of the existing CSMs, (3) complete to the extent that necessary conclusions may be obtained, and (4) accurate at the levels that are appropriate for determining the location of coarse grained intervals for monitoring well installation. Errors will be minimized by adhering to the field QA/QC protocols established in the QAPP and FSP.	Acceptance criteria include confirmation that laboratory data are: (1) representative of the chemical conditions that exist, (2) comparable to subsequent or previously collected data, (3) complete to the extent that necessary conclusions may be obtained, and (4) of known statistical significance in terms of precision and accuracy, at the levels that are appropriate for evaluating COC distribution. Errors will be minimized by adhering to the field QA/QC protocols established in the QAPP and FSP.	Acceptance criteria include confirmation that measurements are collected accurately to within 0.01 foot by repeating the measurement at each well and preparing legible and accurate field notes. Errors will be minimized by adhering to the field QA/QC protocols established in the QAPP and FSP.

Table 3 - Data Quality Objectives for Leading Edge Investigation  
Omega Superfund Site  
Operable Unit 2

Step 7 - Plan for Obtaining Data	Up to five monitoring well screen intervals at each well cluster will be selected as described above. The monitoring well depths and screen intervals will be selected to be in the coarsest grained layers. Geophysical logs will be used to select a screen interval for the deepest monitoring well in each well cluster. After the deepest well is installed, the geophysical and boring logs will be used to select up to four additional monitoring wells at each well cluster.	Groundwater samples will be collected using low-flow sampling procedures with either a submersible pump or bladder pump. Each well will be purged, and field parameters will be monitored during purging. Samples will be collected after field parameters have stabilized as described in the Water Quality Parameter Measurements SOP included in the FSP. All samples from the monitoring wells will be analyzed for VOCs by EPA Method 8260B; hexavalent chromium by EPA Method 218.6; and 1,4-dioxane by EPA Method 8270C SIM. Field and laboratory QA/QC samples will be collected and analyzed.	Water levels will be measured manually using a QED®, Solinst® or comparable flat tape electric water level sounder. Pressure transducers and data loggers will also be installed and used to record water levels for a period of at least one month.
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**Notes:**  
\* - Total trihalomethanes = Bromodichloromethane, Bromoform, Chloroform, Dibromochloromethane

µg/L: micrograms per liter	1,2-DCA: 1,2-Dichloroethane	feet bgs: feet below ground surface	NLs: notification levels	SOW: Statement of Work
µg/kg: micrograms per kilogram	cis-1,2-DCE: cis-1,2-Dichloroethene	Freon 11: trichlorofluoromethane	OU2: Operable Unit 2	TCE: trichloroethene
mg/L: milligrams per liter	COCs: chemicals of concern	Freon 113: 1,1,2-Trichloro-1,2,2,-trifluoroethane	PCE: tetrachloroethene	USGS: United States Geological Survey
mg/kg: milligrams per kilogram	CSMs: Conceptual Site Models	LE: Leading Edge	QA/QC: quality assurance/quality control	VOC: volatile organic compound
1,1-DCA: 1,1-Dichloroethane	DWR: Department of Water Resources	LEI: Leading Edge Investigation	QAPP: Quality Assurance Project Plan	
1,1-DCE: 1,1-Dichloroethene	EPA: Environmental Protection Agency	MCLs: maximum contaminant levels	ROD: Record of Decision	
1,1,1-TCA: 1,1,1-Trichloroethane	FSP: Field Sampling Plan	NA: not applicable	SOP: standard operating procedure	

**References**  
California Code of Regulation Title 22. Sections 64431, 64444, 64449, and 64533. Last updated June 14, 2016  
[http://www.waterboards.ca.gov/drinking\\_water/certlic/drinkingwater/documents/lawbook/dwregulations-2016-06-14.pdf](http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/dwregulations-2016-06-14.pdf)  
Drinking Water Notification Levels and Response Levels: An Overview. Division of Drinking Water State Water Resources Control Board. February 4, 2015  
[http://www.waterboards.ca.gov/drinking\\_water/certlic/drinkingwater/documents/notificationlevels/notificationlevels.pdf](http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/notificationlevels/notificationlevels.pdf)

## FIGURES

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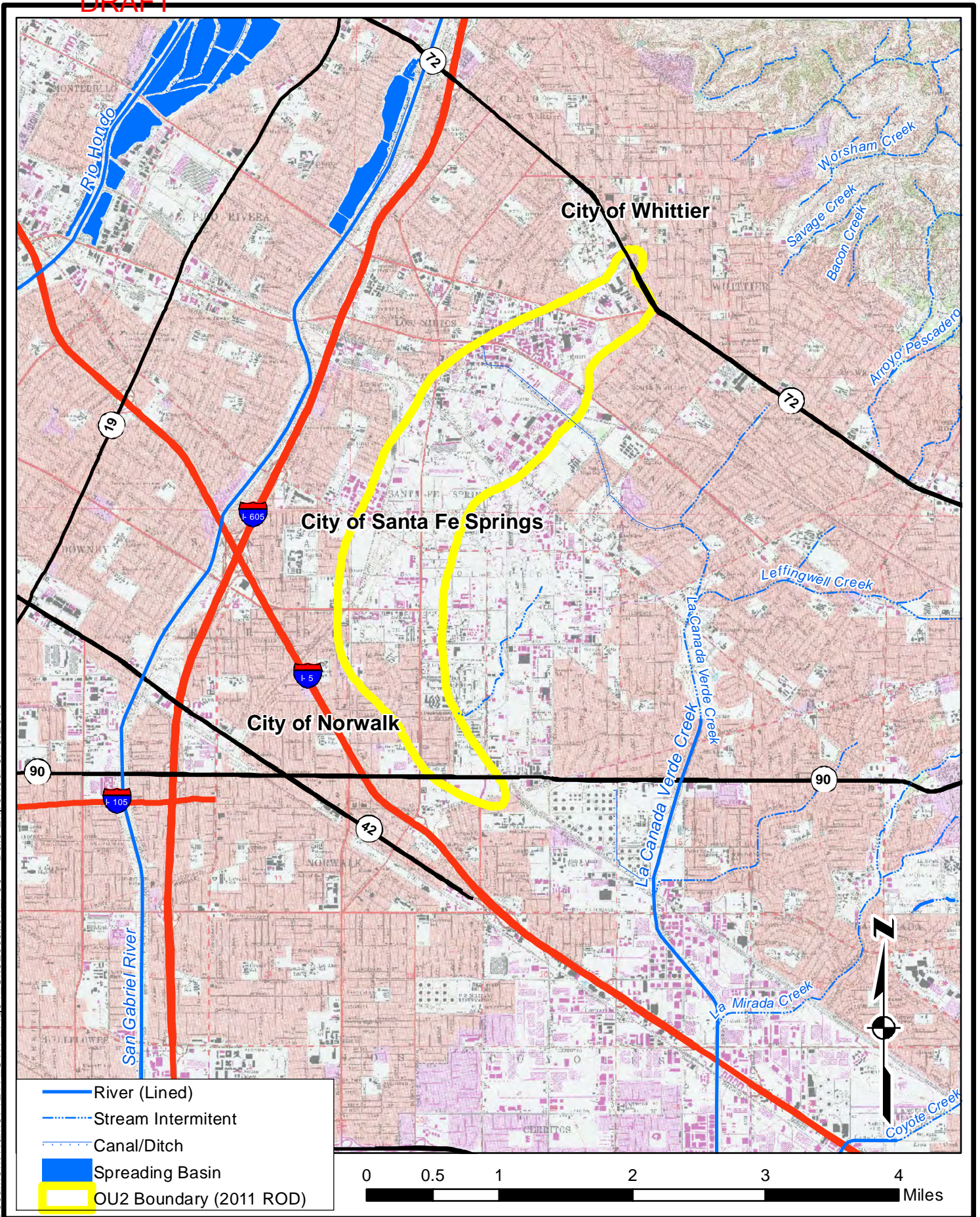


FIGURE 1. SITE LOCATION

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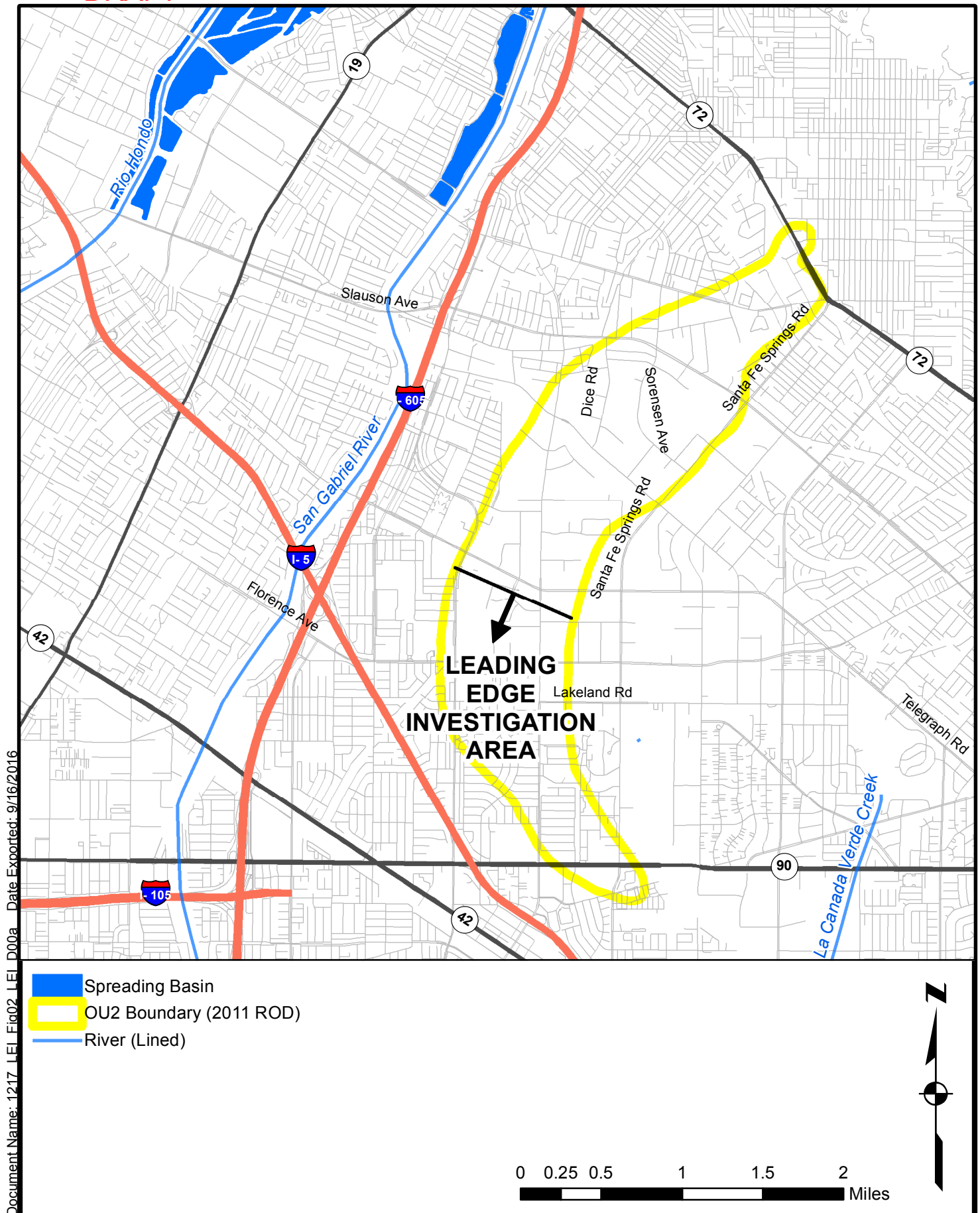


FIGURE 2. LEADING EDGE AREA

 Proposed Monitoring Well Cluster  
 Operable Unit 2 (OU2) Boundary



Omega Superfund Site - OU2  
Los Angeles County, California

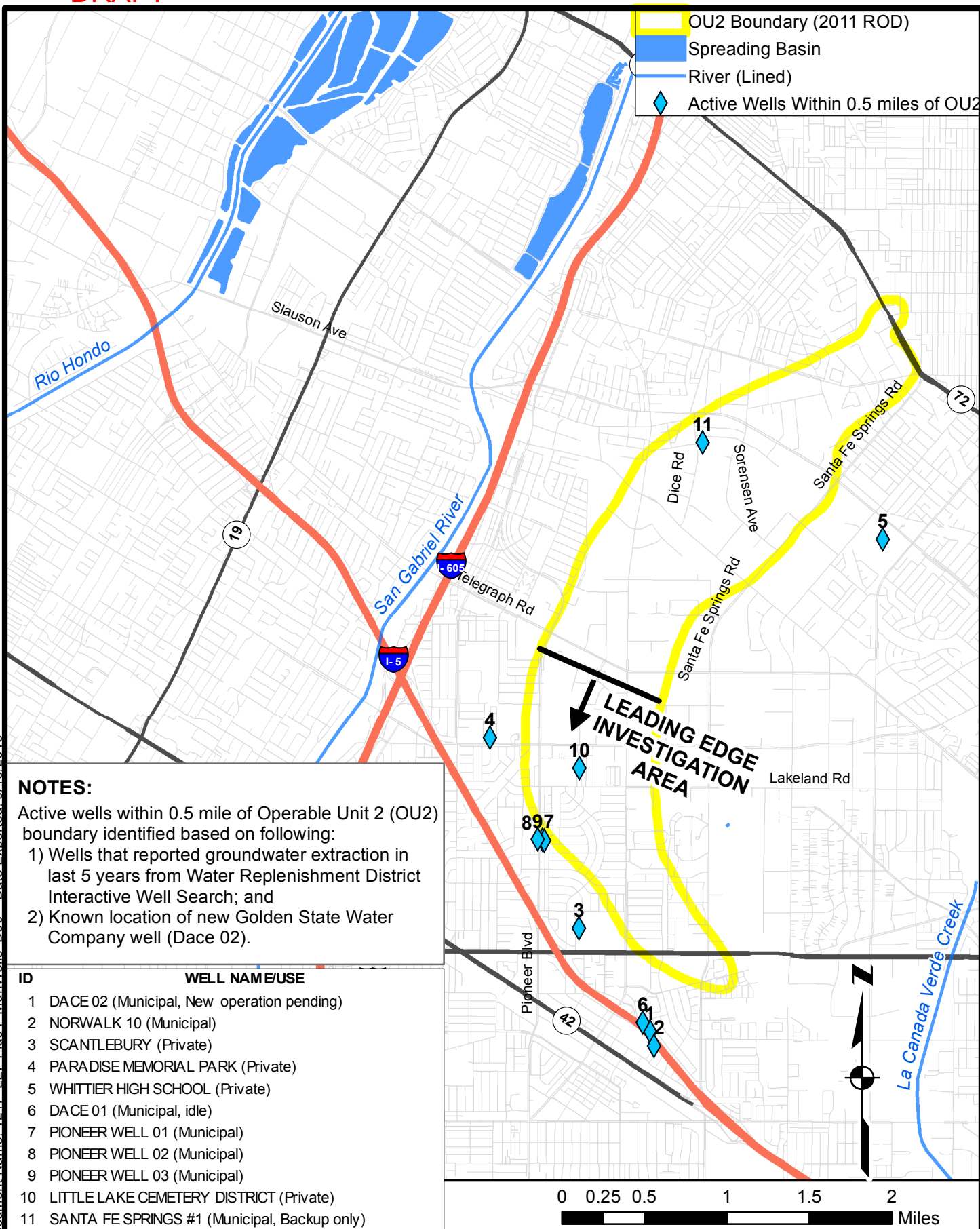
Geosyntec   
consultants

3

July 2016

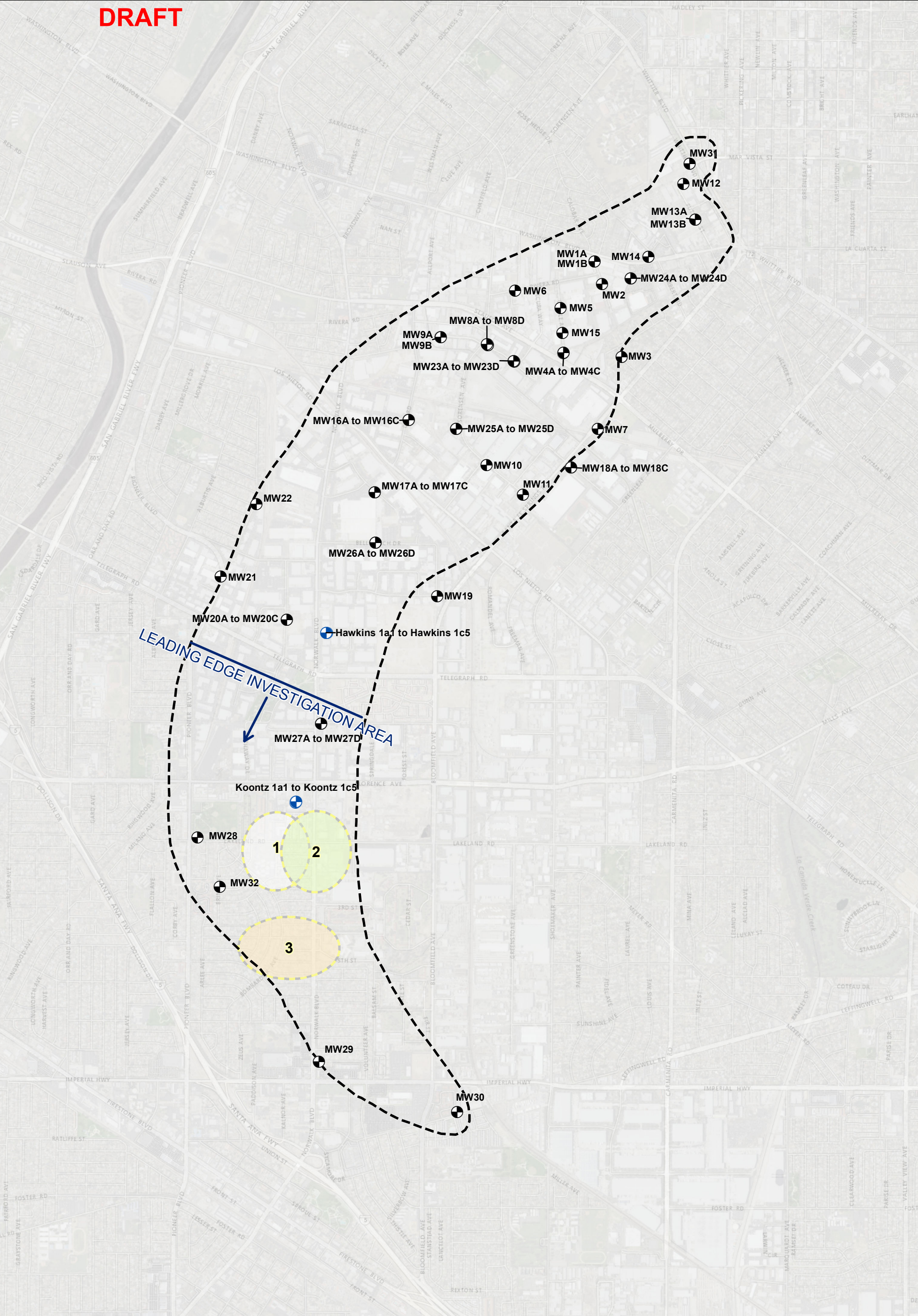
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Document Name: 1217\_LEI\_Fig04\_MunWells\_D00 Date Exported: 9/16/2016



**FIGURE 4. ACTIVE GROUNDWATER PRODUCTION WELLS WITHIN 1/2 MILE OF OPERABLE UNIT 2**

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**Legend**

**Monitoring Wells**

- Installed by EPA
- Installed by WRD

**Notes:**

Wells co-located in groups of three or more have been labelled as a group (eg; MW26A to MW26D). Locations of the LEI monitoring wells will be determined during well installation activities (Geosyntec, 2016). LEI = Leading Edge Investigation WRD = Water Replenishment District OU2 = Operable Unit 2 ROD = Record of Decision

OU2 Boundary (2011 ROD)

Proposed LEI Monitoring Well Cluster

0 2,000 Feet

**Work Area Monitoring Network**

Omega Superfund Site - OU2  
Los Angeles County, California

**Geosyntec**  
consultants

**Figure**

**5**

WR2209

September 2016



- OU2 Boundary (2011 ROD)
- River (Lined)
- Spreading Basin
- Residential
- Schools, Parks and Recreational Areas
- Commercial / Industrial

NOTES:

This dataset was developed in 2009 by the Southern California Association of Governments (SCAG) to provide a Countywide zoning and general plan information. (<http://egis3.lacounty.gov/dataportal/2012/04/10/countywide-zoning/>).

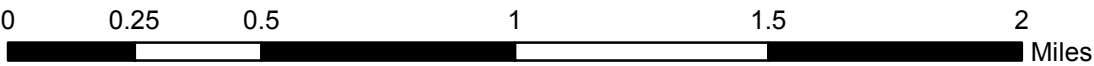
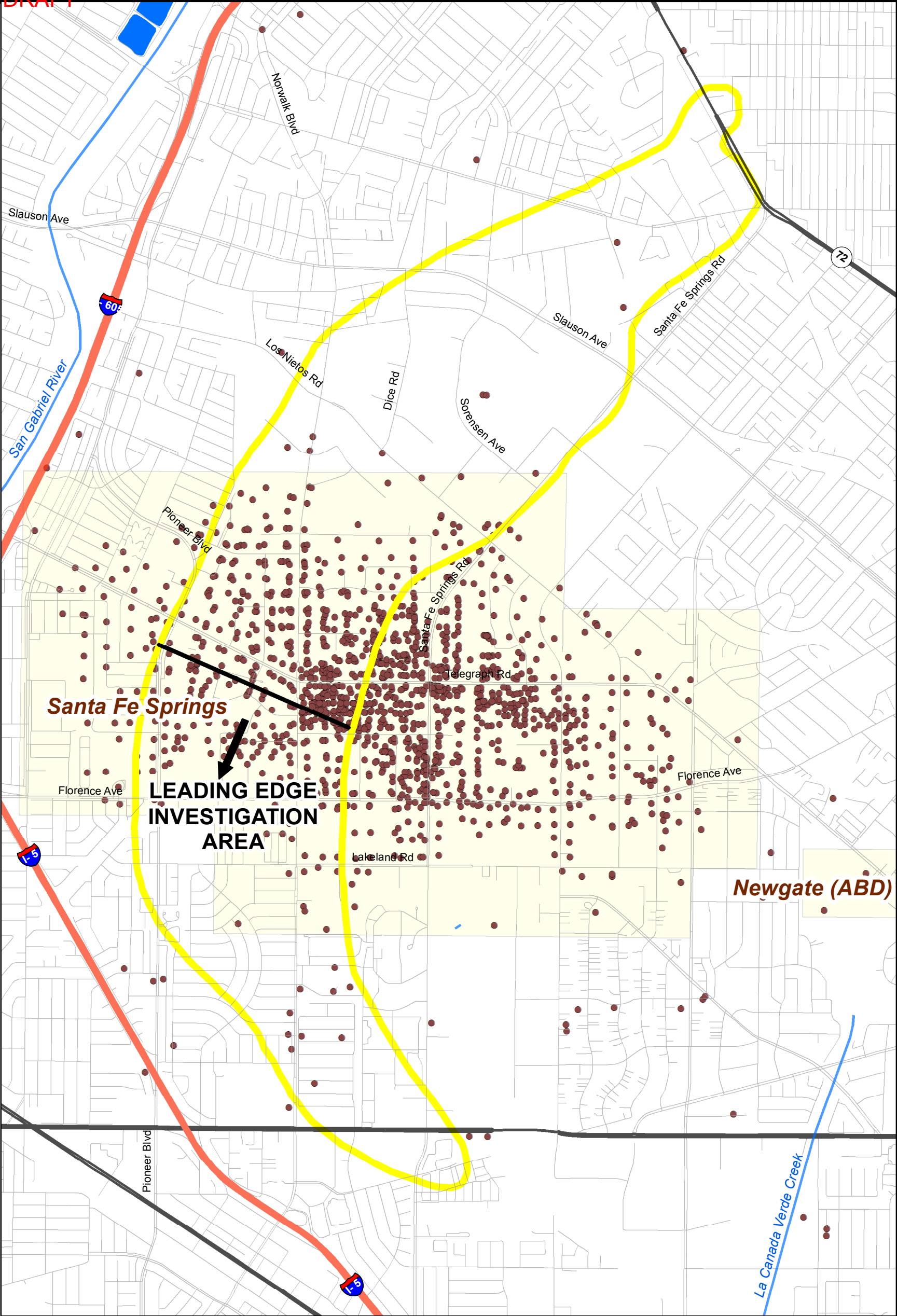


FIGURE 6. LAND USE IN AND AROUND OU2

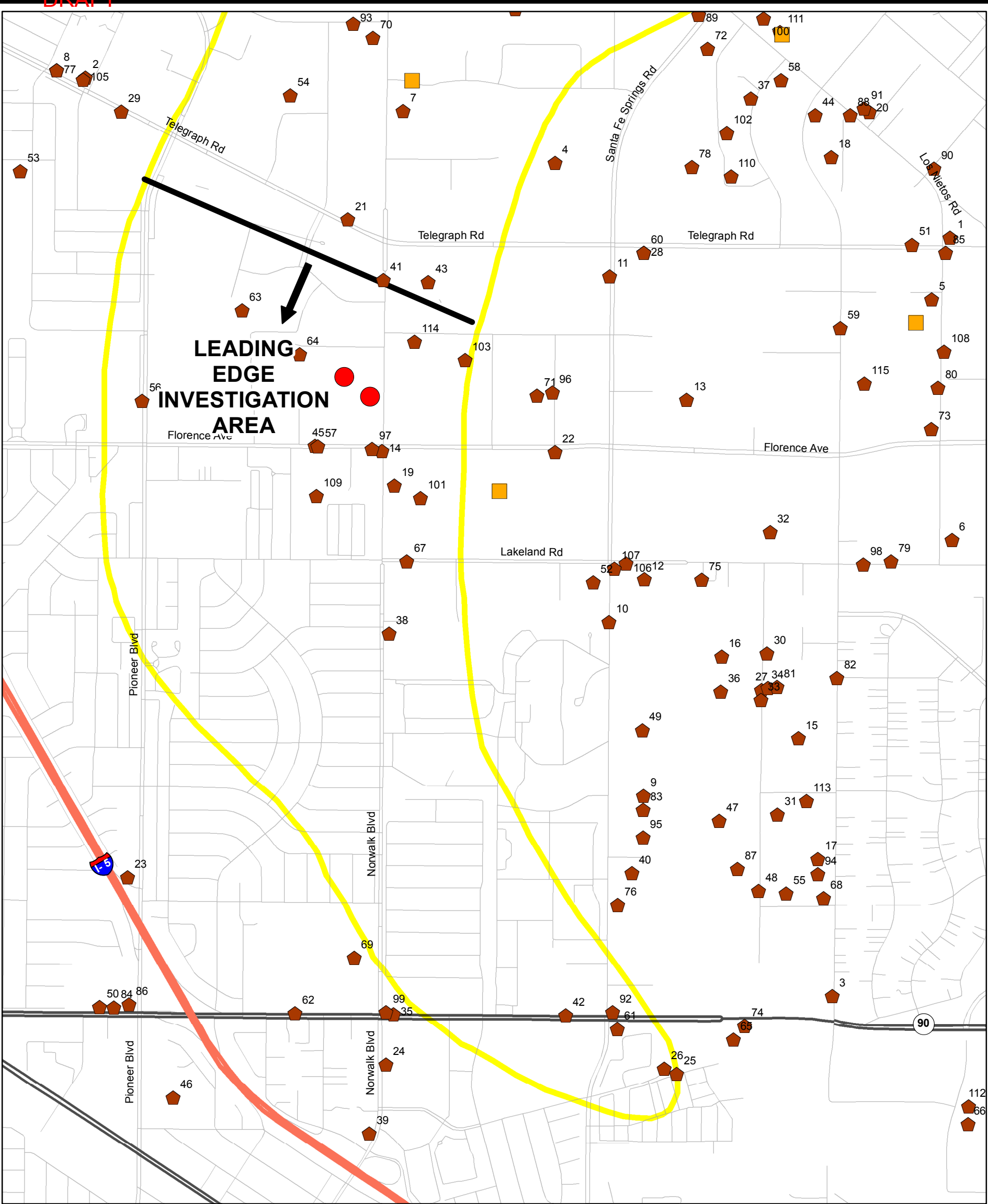


- OU2 Boundary (2011 ROD)
- River (Lined)
- Oil Wells (Any Status)
- Oil Field Boundary - Department of Conservation

**NOTES:**

The California Department of Conservation, Division of Oil, Gas and Geothermal Resources publishes a GIS feature class of well locations and well field locations across the state for use by the public. The data was downloaded from (<http://maps.conservation.ca.gov/doggr/index.html>) as of July 6, 2016.

FIGURE 7. SANTA FE SPRINGS OIL FIELD



- OU2 Boundary (2011 ROD)
- Potential Source Sites
- OU2 Special or General Notice Sites
- Known or Potential Source Site (RI Report)

**NOTES:**  
OU2 Special or General Notice Sites have been identified by EPA as known source properties.

Known or Potential Source Sites have been identified in the Remedial Investigation (RI) Report and does not include OU2 Special or General Notice Sites.

Supplemental identifications are based on Geotracker, Envirostor and other sources of information (refer to table for additional information).

ROD - Record of Decision  
OU2 = Operable Unit 2

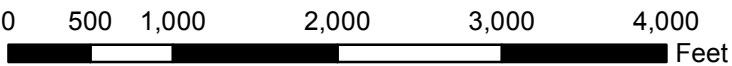


FIGURE 8. SUPPLEMENTAL OU2 SOURCE IDENTIFICATION, LEADING EDGE INVESTIGATION AREA VICINITY

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\\oakland-01\data\GIS\Omega\Project\2016\LE\workplan\Fig-09\_MainPhysiographicFeaturesInOU2.ai"

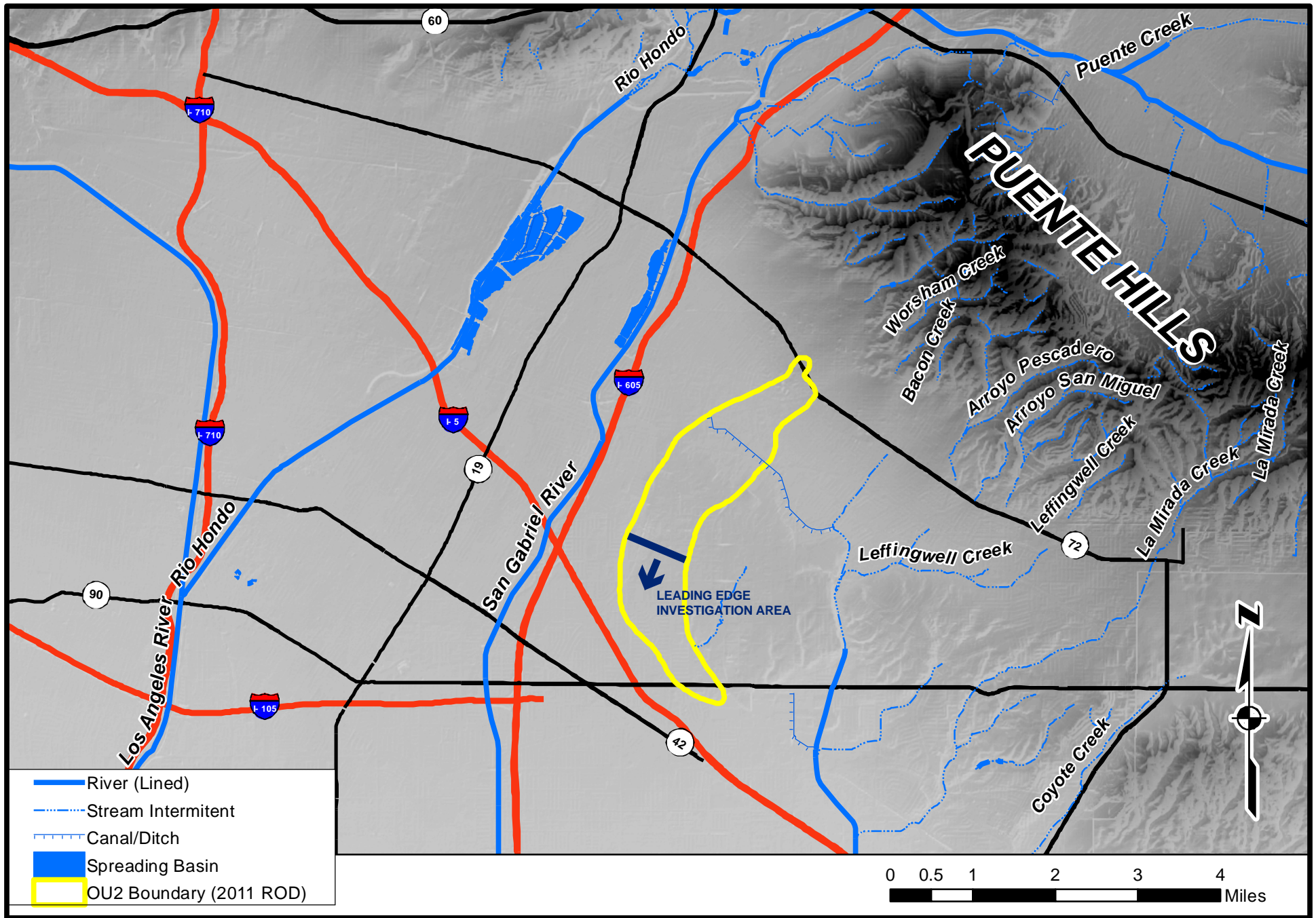
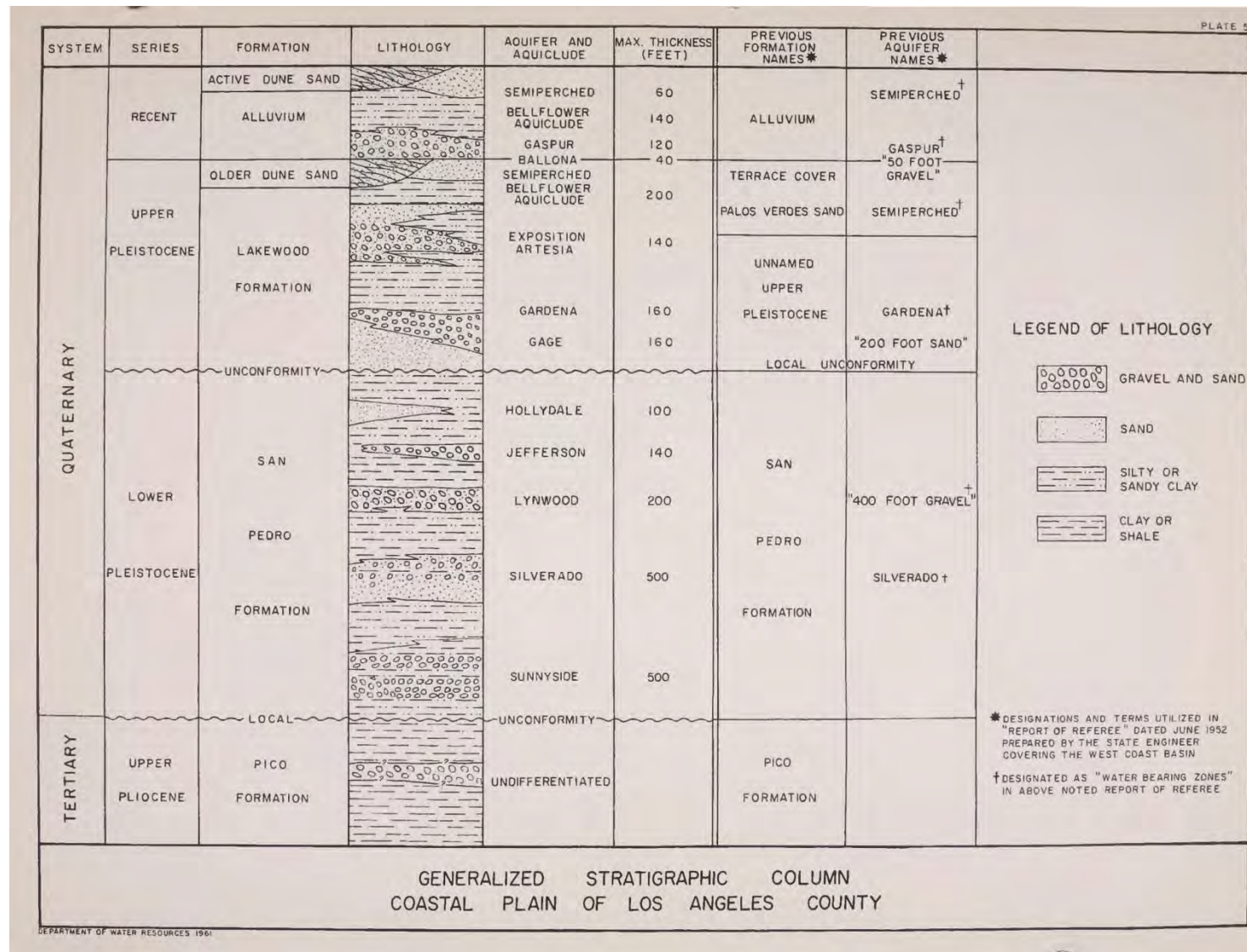


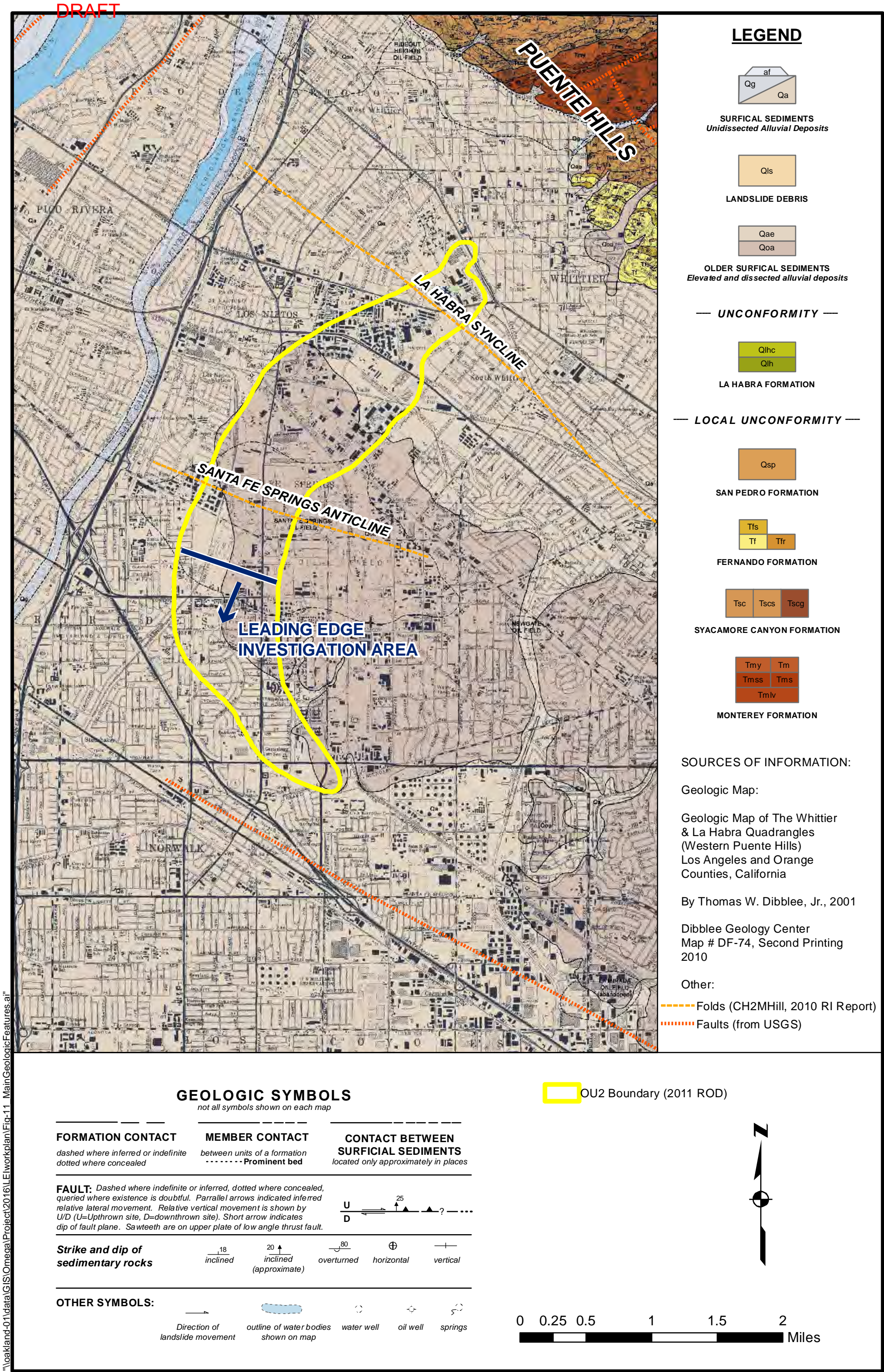
FIGURE 9. MAIN PHYSIOGRAPHIC FEATURES IN OU2

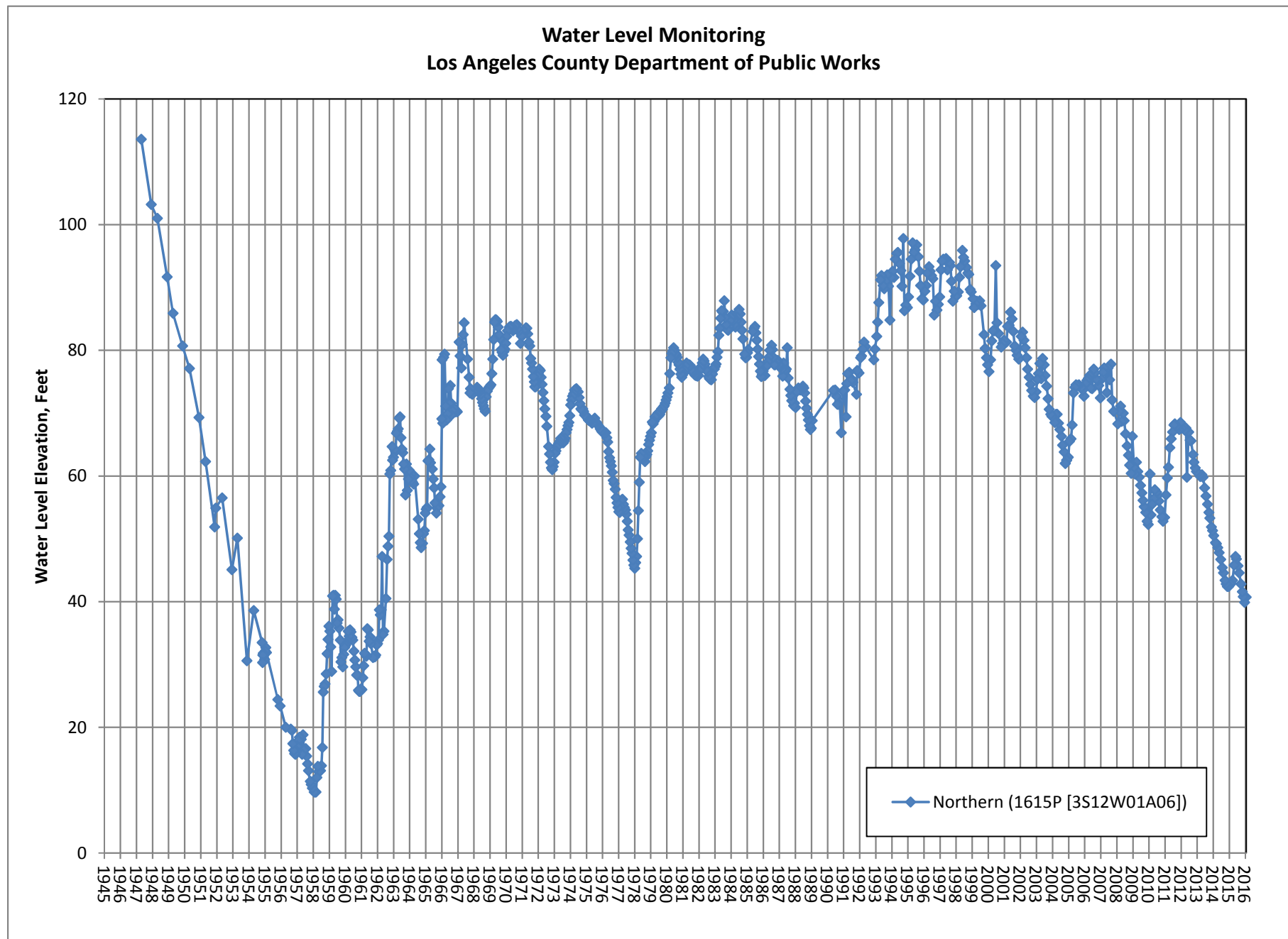
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Reprinted from California Department of Water Resources Bulletin 104, 1961, Plate 5.

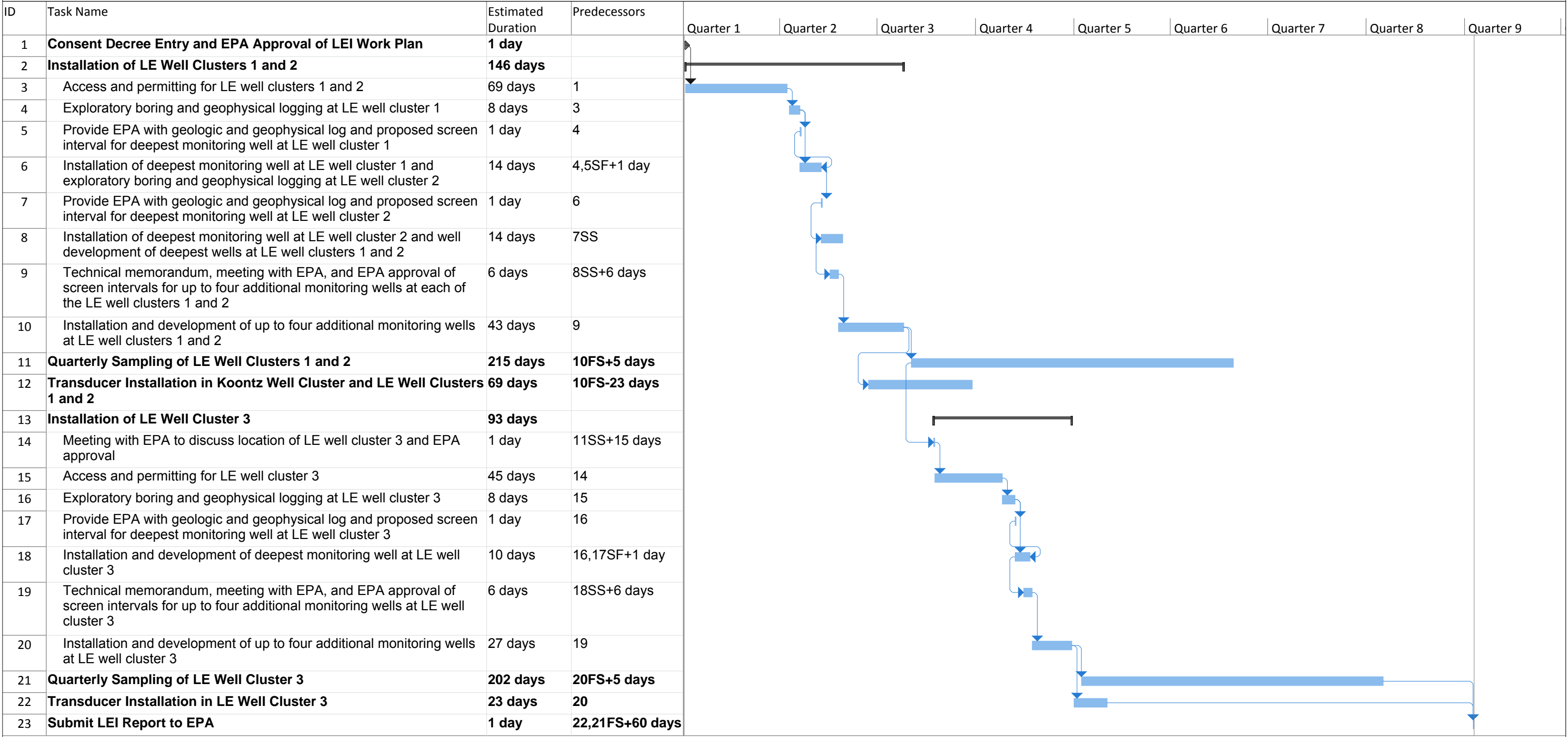
**FIGURE 10. GENERALIZED STRATIGRAPHIC COLUMN, COASTAL PLAIN OF LOS ANGELES COUNTY**





**FIGURE 12. HISTORICAL GROUNDWATER HYDROGRAPH**

Figure 13  
LEI Work Plan Project Schedule  
Omega Superfund Site  
Operable Unit 2



Project: LEI Work Plan Project Schedule  
Date: Tue 9/27/16  
Notes:  
EPA – United States Environmental Protection Agency  
LE – Leading Edge  
LEI – Leading Edge Investigation

Task	<div></div>	External Tasks	<div></div>	Manual Task	<div></div>	Finish-only	<div></div>
Split	<div></div>	External Milestone	<div></div>	Duration-only	<div></div>	Deadline	<div></div>
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Project Summary	<div></div>	Inactive Summary	<div></div>	Start-only	<div></div>		<div></div>

# APPENDICES